# THE PLANT DISEASE REPORTER

**Issued By**

CROPS RESEARCH DIVISION

AGRICULTURAL RESEARCH SERVICE

**UNITED STATES DEPARTMENT OF AGRICULTURE**

ROOTROT AND RELATED LITERATURE
AN ANNOTATED BIBLIOGRAPHY, 1958

Supplement 256

June 15, 1959

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Crops Research Division serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

MYCOLOGY AND PLANT DISEASE REPORTING SECTION

Crops Protection Research Branch — Plant Industry Station, Beltsville, Maryland

# ROOTROT AND RELATED LITERATURE AN ANNOTATED BIBLIOGRAPHY, 1958[1]

The Staff[2]

Plant Disease Reporter
Supplement 256

June 15, 1959

## INTRODUCTION

To facilitate rootrot research, to emphasize its importance as a distinct entity in plant pathology, and also to help to avoid unnecessary duplication of effort in searching the literature, the following annotated bibliography has been prepared from references appearing in periodicals published in 1958.

## CONTENTS

| | Page |
|---|---|
| Actinomycetes | 65 |
| Antibiotics | 66 |
| Bacteria | 67 |
| Biological Control | 73 |
| Control | 77 |
| Fungi | 78 |
| Insecticides | 120 |
| Methods and Techniques | 120 |
| Nematode Control | 122 |
| Nematodes | 132 |
| Nutrition | 149 |
| Soil Fungicides | 150 |
| Soil Insects and Fungi | 162 |
| Toxins and Other Substances of Biotic Origin | 162 |
| Virus | 169 |
| Senior Author Index | 170 |
| Acknowledgment | 174 |

[1] Contribution No. 2, from the Research Station, Research Branch, Canada Department of Agriculture, Harrow, Ontario.

[2] L. W. Koch, Director; A. A. Hildebrand, C. D. McKeen, Z. A. Patrick, R. N. Wensley and N. J. Whitney, Pathology Section; W. B. Mountain, R. M. Sayre, Nematology Section; and H. R. Boyce, Entomology Section.

## ACTINOMYCETES

See also 53, 68, 77, 99, 120, 121, 407, 679

1. EICHINGER, A. Kartoffelschorf und Oxalsäure. (Potato scab and oxalic acid.) Z. Acker-u. PflBau 105: 451-458. 1958. (Rev. Appl. Mycol. 37: 555. 1958.)
   This is a study of changes induced in the skin of potato tubers by deposits of Ca cations as related to infection by scab (Streptomyces scabies). A schedule of soil amendments is recommended, based on the hypothesis that the oxalic acid produced by the plant is the strongest inactivator of these ions. Synthetic fertilizers containing Mg and Na should be excluded, since their ions compete with those of Ca for oxalic acid. It is thought likely that resistance to scab is influenced by the capacity of different varieties for oxalic acid formation.

2. ELLETT, C. W. Bacteria parasitic on plants in Ohio. Ohio J. Sci. 58: 145-149. 1958. (Rev. Appl. Mycol. 37: 639. 1958.)
   Included in this list is Streptomyces scabies on beet, radish and potato.

3. GUNTZ, M., and M. COPPENET. Essais de traitements contre la gale commune de la pomme de terre. (Spray trials against common scab of potato.) Phytiatrie-Phytopharm. 6: 187-195. 1957. (Rev. Appl. Mycol. 37: 555-556. 1958.)
   To control Streptomyces scabies on potato the soil was treated with a number of organic and inorganic compounds. The only treatments giving results that justified the expense involved were sulphur and PCNB.

4. MARTIN, W. J. Reaction of sweet potato varieties and seedlings to soil rot. Phytopathology 48: 445-448. 1958.
   Studies on varietal reaction to soil rot of sweet potato, incited by Streptomyces ipomoea (Person & W. J. Martin) Waksm. & Henrici, have shown rather clear-cut differences among varieties, selections, and breeding lines, ranging from susceptibility (in Unit I Porto Rico, the principal variety planted in Louisiana) through some degree of tolerance (in the Heartgold and Acadian varieties) to considerable resistance (in certain other selections and breeding lines).

5. McKEE, R. K. Assessment of the resistance of potato varieties to common scab. Europ. Potato J. 1 (1): 65-80. 1958. (Rev. Appl. Mycol. 37: 505. 1958).
   At the Nottingham University School of Agriculture a number of imported potato varieties resistant to common scab (Streptomyces scabies) were compared with a number of British ones. Techniques of soil inoculation and methods of rating scab are described. Results of greenhouse and field trials were closely parallel. The periderm test was used in most cases in the separation of resistant from susceptible varieties. A number of isolates of the pathogen were found to differ greatly in respect of virulence but there was no evidence of physiological specialization.

6. PHILLIPS, D. H. Report of the Mycological Department. Rep. States Jersey, 1956, 39-44. 1957. (Rev. Appl. Mycol. 37: 261. 1958.)
   This report notes that common scab (Actinomyces (Streptomyces) scabies) was unusually prevalent on potatoes.

7. PIERINGER, A. P. A greenhouse method for determining the disease reaction of potato seedlings to common scab caused by Streptomyces scabies (Thaxt.) Waks. & Henrici. Diss. Abstr. 17: 5. 1957. (Rev. Appl. Mycol. 37: 307. 1958.)
   Equal parts of vermiculite and normal potting soil infested by S. scabies was superior to infested normal soil as an infection medium in testing for resistance. There was a good distribution of the organism in the soil. Gives the effect of vermiculite, under wet and dry conditions, on the viability of S. scabies. Also, gives effect of long periods of high daytime greenhouse temperatures on viability. The type of tuber periderm was a measure of the resistance to the disease.

8. TURNER, P. B. The effect of calcium-potassium ratios on the incidence of potato scab. Diss. Abstr. 17: 1441-1442. 1957. (Rev. Appl. Mycol. 37: 417. 1958.)

This work was done to determine the effect on the incidence of potato scab of added increments of potassium and zinc. When, in 1951, the Ca-K ratio approached unity, Katahdin potatoes gave increased yields and were less affected by scab. The 1952 data, however, did not confirm this trend. 1953 results confirmed 1951 data. Zinc had no effect on scab or on yield. In the greenhouse, lime in bands at 9-inch depth did not reduce scab or increase yield of Chippewa potatoes at either of two pH levels, but tubers at pH 5.6 with 1000 lb. lime/acre mixed throughout the top 9 inches were the freest from scab and the largest harvested.

## ANTIBIOTICS

See also 394, 624, 687

9. ABO-EL-DAHAB, M. K. Effects of certain antibiotics on representative phytopathogenic bacteria with special reference to Pseudomonas solanacearum. Diss. Abstr. 17: 2391-2392. 1957. (Rev. Appl. Mycol. 37: 520-521. 1958.)

The reactions of 34 species and strains of phytopathogenic bacteria to 10 antibiotics (names given) were investigated. Description is given of reactions of Agrobacterium, Corynebacterium, and Pseudomonas species. Detail is given of the reaction of Pseudomonas solanacearum strains and mutants to a number of the antibiotics. The nutritional characteristics of each strain are discussed in relation to the reaction of the strain to any particular antibiotic.

10. ARK, PETER A. and DAVID J. BINGHAM. Response of pear and cherry root stocks to streptomycin and tetracycline when applied to control crown gall. Plant Disease Reptr. 42: 673-674. 1958.

Two antibiotics, streptomycin and tetracycline, which showed a high degree of activity against Agrobacterium tumefaciens in vitro, were tested under field conditions on French pear and Mazzard cherry seedling rootstock obtained from nurseries where the soil was known to be contaminated with crown gall bacteria. The roots and tops of the seedlings were pruned and dipped for 1 hour in the solutions. No perfect control was obtained. There was a very pronounced difference in the response of the different rootstocks to both streptomycin and tetracycline.

11. BONDE, REINER and BARBARA JOHNSON. Studies on the additive effect of streptomycin sulfate on different seed potato disinfectants for the control of bacterial ring spot. Plant Disease Reptr. 42: 781-784. 1958.

Experiments were conducted to discover a seed potato disinfectant that will control the dissemination of ring rot (Corynebacterium sepedonicum) during the process of cutting seed potatoes. Seed pieces contaminated with the bacteria were treated with different disinfectants with and without streptomycin sulfate in the dipping solutions. Most of the disinfectants gave significantly better disease control when combined with streptomycin sulfate than they gave without this antibiotic. Streptomycin sulfate appeared to have an additive or synergistic effect when in combination with the disinfectants used for the control of the ring rot disease. Acti-dione was the only antibiotic used in these studies that materially injured the potato seed pieces and reduced germination when they were planted in the field.

12. DEEP, IRA W. Crown gall chemotherapy with Terramycin. Plant Disease Reptr. 42: 1210-1213. 1958.

Incipient crown gall infections were eliminated from 1-year-old Mazzard cherry trees by a 400-ppm treatment with Terramycin for 50 minutes. An 800 ppm treatment with Terramycin for 15 minutes prevented infection by crown gall bacteria when the trees were planted in infested soil. Neither of these treatments was phytotoxic in the instances cited but they have been injurious in other trials.

13. DEEP, IRA W. Reduction in incidence of crown gall of Mazzard cherry following antibiotic treatments. Plant Disease Reptr. 42: 476-478. 1958.

Three antibiotic preparations, streptomycin sulfate, Agrimycin, and Terramycin, were tested for effectiveness in root treatments of Mazzard cherries to prevent crown gall caused by Agrobacterium tumefaciens (E. F. Sm. & Towns) Conn. All three preparations significantly reduced the incidence of infection, but Terramycin was by far the most effective. Chemotherapeutic activity was indicated. Best treatments from viewpoint of maximum effectiveness and minimum toxicity were Terramycin at 200 ppm for 1 hour and at 400 ppm for 15 minutes.

14. FINK, HENRY C. Streptomycin-fungicide mixtures as potato seed piece treatments. Plant Disease Reptr. 42: 965-971. 1958.

Seed-piece rot (Erwinia atroseptica) was controlled in the laboratory with streptomycin sulfate at 100 ppm. Mixtures of a number of fungicides and dieldrin with streptomycin did not have an adverse effect on control in the laboratory. There was no correlation between laboratory and field tests; no treatment investigated gave complete control of E. atroseptica in the field. Where fungicide-streptomycin mixtures were used, lower stands and yields were produced than where fungicides (except griseofulvin) alone were used, especially when streptomycin was added to glyodin, Fermate 10 lb., Fermate 5 lb., or Spergon 3 lb.; addition of dieldrin to the streptomycin-fungicide mixtures reversed this tendency, apparently by reducing the phytotoxicity of the mixtures.

15. MACLACHLAN, D. S. and M. D. SUTTON. The use of antibiotics in the control of potato ring rot. Rep. Quebec Soc. Prot. Pl., 1956: 76-82. 1957. (Rev. Appl. Mycol. 37: 371. 1958.)

In field trials on the use of several antibiotics in the control of the potato ring rot organism (Corynebacterium sepedonicum), the most promising was Terramycin which can be absorbed by actively growing potato plants through the roots and translocated to the growing point in 24 hours, the concentration there reaching a maximum within 48 hours. Other tests indicated that Terramycin moves down one branch and up to the tip of the adjoining branch. When, however, sap from the base of the stems was assayed Terramycin was not found.

16. PORTER, FRANK M. and CARROLL E. COX. Some effects of certain antibiotics and other organic chemicals on the growth of Sclerotium rolfsii in the laboratory. (Abstr.) Phytopathology 48: 463. 1958.

17. WINFREE, J. P., R. S. COX and D. S. HARRISON. Influence of bacterial soft rot, depth of water table, source of nitrogen and soil fumigation on production of lettuce in the Everglades. Phytopathology 48: 311-316. 1958.

Soft rot of lettuce due to Erwinia sp. and possibly Pseudomonas sp. was studied at the Everglades Experimental Station, Florida, in 1955-1957. Streptomycin gave some control in the field but at effective strengths (100-200 ppm) tended to be phytotoxic. Tribasic Copper Sulfate plus Agrimycin-100 applied throughout the season reduced diseased heads from 96 percent (untreated) to 64 percent.

## BACTERIA

See also 9, 10, 11, 12, 13, 14, 15, 61, 66, 94, 120, 134, 160, 199, 218, 253, 349

18. ARK, PETER A. and MILTON N. SCHROTH. Use of slices of carrot and other fleshy roots to detect crown gall bacteria in soil. Plant Disease Reptr. 42: 1279-1281. 1958.

The crown gall bacterium, Agrobacterium tumefaciens, forms good galls on slices of carrots, rutabagas, turnips, and table beets. Carrot root slices are found to be the best in detecting living organisms of crown gall in soil and galls can be seen on carrot slices after 5 or 7 days.

19. BELTRA, R. El agente etiologico de la tuberculosis del olivo en relacion con el suelo. (The etiological agent of olive tubercle in relation to soil factors. An. Edafol. y. Fisiol. Veg. 16: 557-577. 1957. (Biol. Abstr. D, 32: 2083. 1958.)

The relationship of various soil factors, including texture, structure, pH, and chemical composition, to the olive tubercle disease (Pseudomonas savastanoi) is discussed.

20. BUDDENHAGEN, I. W. and L. SEQUEIRA. Disinfectants and tool disinfection for prevention of spread of bacterial wilt of bananas. Plant Disease Reptr. 42: 1399-1404. 1958.

A number of organic and inorganic chemicals were tested as possible materials for disinfection of pruning knives, which are responsible in many cases for the transmission from plant to plant of bacterial wilt of bananas caused by Pseudomonas solanacearum E. F. Smith. Due either to the instability of most of these chemicals in the presence of banana sap, or to their toxicity, only formaldehyde was considered satisfactory for field use.

21. DAVISON, ARLEN D. Plant diseases of economic crops occurring in Wyoming during 1958. Plant Disease Reptr. 42: 1409-1410. 1958.

In the section on potato diseases it is reported that there occurred 1/10 of 1 percent ring rot, Corynebacterium sepedonicum (Spieck. & Kotth.) Skapt. & Burkh., infection in potato fields entered for certification. Fusarium solani (Mart.) Appel & Wr. f. phaseoli (Burkh.) Snyd. & Hans. root rot was moderate to severe in bean fields throughout the State.

22. DOWSON, W. J. Plant diseases due to bacteria. Second edition. Pp. XV + 232 + 30 plates and 21 maps. (Cambridge: University Press, 1957.) Review in Nature 181: 1094-1095. 1958.

New British diseases dealt with include silvering of red beet (Corynebacterium betae Keyworth, Howell & Dowson) and slow wilt of carnation caused by a bacterium related to, if not identical with, Pectobacterium carotovorum f. sp. chrysanthemi Dowson.

23. FULKERSON, J. F. Differential response of alfalfa clones to variant forms of Corynebacterium insidiosum. (Abstr.) Phytopathology 48: 461. 1958.

This investigation determined the relative virulence of different isolates of the wilt organism, C. insidiosum. Root inoculation tests were used. Four alfalfa clones were inoculated, each having a known degree of susceptibility to the wild-type isolate. There was a difference between this isolate and another one as determined by differential host reaction, i.e., clone 83 was significantly more susceptible to the variant than to the wild-type isolate.

24. GARBER, E. D. Further data on the concentration of free histidine of turnip varieties and their response to inoculation with histidine-requiring mutants of Erwinia aroideae. Am. J. Botany 45: 523-525. 1958. (Chem. Abstr. 52: 18702d. 1958.)

The fleshy storage organs of three varieties of turnips, and three mutants of the organism, were used. Twelve plants of each variety showed these ranges in $\mu$g histidine/g fresh weight: 7-22, 5-44, 19-146. There was no relation between these contents and susceptibility to the mutants.

25. GRAHAM, C. D. Occurrence of soft rot bacteria in Scottish soils. Nature 181: 61. 1958. (Rev. Appl. Mycol. 37: 267. 1958.)

Seventeen widely different soil samples were examined for the presence of soft rot bacteria (Erwinia atroseptica), the cause of blackleg of potato. Most of the isolates that were capable of rotting potato tuber slices at 26° C were Pseudomonas spp. Suspensions of E. atroseptica were added to the various soils in jars. Some of these were buried to the neck in the field from November, while others were kept at room temperature. The only soft rot organisms that could be isolated in the following May were Pseudomonas spp.

26. GRANHALL, I. (Report of 10th Congress of the Scandinavian Agricultural Scientists' Society -- Stockholm 1956.) Nord. Jordbr. Forskn. 38 (1956): 137-531. 1957. (Rev. Appl. Mycol. 37: 571. 1958.)

This author contributed a general paper on "Ring rot (Corynebacterium sepedonicum) in potatoes" in Sweden and its control.

27. HUSAIN, AKHTAR and ARTHUR KELMAN. Relation of slime production to mechanism of wilting and pathogenicity of Pseudomonas solanacearum. Phytopathology 48: 155-165. 1958.

Culture filtrates of a highly pathogenic strain of Pseudomonas solanacearum caused wilting of tomato cuttings, whereas culture filtrates of weakly pathogenic and avirulent strains did not. A heat-stable, viscous substance capable of causing reversible wilting of tomato cuttings was obtained by alcoholic precipitation from the culture filtrate of the virulent strain. This substance was not present in the culture filtrates of the weakly pathogenic or avirulent strains. The substance appeared to be a complex polysaccharide of a high molecular weight, with glucose as a main component. The substance was present in a bacterial slime around cells of the pathogenic strain. It was shown experimentally that this extracellular polysaccharide or slime produced by the virulent strain is the primary wilting factor in tomato.

28. HUSAIN, AKHTAR and ARTHUR KELMAN. The role of pectic and cellulolytic enzymes in pathogenesis by Pseudomonas solanacearum. Phytopathology 48: 377-386. 1958.

Study was made of the production of pectic and cellulolytic enzymes of P. solanacearum and certain of their functions in the disease syndrome were determined. Liquid culture filtrates of three strains of P. solanacearum differing in pathogenicity contained pectinmethylesterase, polygalacturonase, and a cellulolytic enzyme. Two conclusions were arrived at relative to the mechanism involved in two major phases of pathogenesis: Induction of wilting and decomposition of tissues. The pectic enzymes were not involved in the wilting process. The possibility exists that the cellulolytic enzymes may play a subsidiary role in the wilting mechanism. Pectic and cellulosic constituents of the cell walls of tomato stems were decomposed by the enzyme systems of the pathogen. It was concluded that the main role of the enzymes of P. solanacearum in pathogenesis involves the breakdown of host tissue.

29. KIVILAAN, A. and R. P. SCHEFFER. Factors affecting development of bacterial stem rot of Pelargonium. Phytopathology 48: 185-191. 1958.

Although this is primarily a disease of the above-ground parts of the plant, it was demonstrated in this investigation that root invasion does occur. Twenty-five plants were inoculated by dipping the free roots in bacterial suspensions. Seventeen of these plants developed positive stem rot symptoms.

30. KLEIN, R. M. and J. L. KNAPP. Sterile induction of crown-gall tumors on carrot tissues in vitro. Proc. Nat. Acad. Sci. Wash. 43: 199-203. 1957. (Rev. Appl. Mycol. 37: 572. 1958.)

This paper describes refinements of techniques used for studying the synthesis and activity of the tumor-inducing principle, which appears to be a metabolic product of virulent crown-gall bacteria (Agrobacterium tumefaciens). The transformation of normal into tumor cells can occur only with the cooperation of a "heat labile" synthesis factor present in a number of plants, including beet, parsnip, and carrot roots, potato tubers, and unspecified herbaceous stems. Evidence suggests that the tumor-inducing principle is a deoxyribonucleic acid.

31. KLEMM, M., G. MASURAT and S. STEPHAN. Das Auftreten der wichtigsten Krankheiten und Schädlinge der Kulturpflanzen im Jahre 1953 im Bereich der Deutschen Demokratischen Republick. (The occurrence of the most important diseases and pests of cultivated plants in the year 1953 in the zone

of the German Democratic Republic.) NachrBl. dtsch. PflSchDienst, Berl., N.F., 11: 81-104. 1957. (Rev. Appl. Mycol. 37: 201. 1958.)

Root diseases of beet (Phoma betae, Pythium debaryanum, Aphanomyces laevis, etc.) were more frequent than in the previous year and severest in Mecklenburg and Saxony. Black leg (Erwinia spp.) of potatoes caused important losses in almost all regions, as also did virus diseases.

32. LUCAS, G. B. Tobacco diseases in Panama. Plant Disease Reptr. 42: 1301. 1958.

Granville wilt, caused by Pseudomonas solanacearum, is reported as one of the diseases.

33. MACLACHLAN, D. S. Machinery and warehouse disinfection in potato ring rot control. Potato Handb. 1958: 31-32. 1958. (Rev. Appl. Mycol. 37: 556. 1958.)

This note briefly describes disinfection measures against potato ring rot (Corynebacterium sepedonicum). Quaternary ammonium compounds have proved superior to other disinfectants for equipment. Semesan Bel (1 lb./10 gal.) and mercuric chloride (1:1,000 or 500) are recommended for disinfection of cutting knives.

34. MARCELLI, E. (Bacterial wilt (Pseudomonas solanacearum) of tobacco in Italy.) Ric. fitop. Campan. 13-14: 53-68. 1957. (Rev. Appl. Mycol. 37: 421. 1958.)

After reporting the occurrence of Pseudomonas solanacearum on tobacco in various parts of Italy, the author gives an account of the disease in semi-popular terms, based largely on the literature.

35. MEYER VON GREGORY, RUTH and HANS WARTENBERG. Untersuchungen über den Parasitismus von Erwinia phytophthora (Appel) Holland. (In German) Phytopath. Z. 32: 257-282. 1958.

36. MORGAN, O. D. Blackleg of tobacco in Maryland. Plant Disease Reptr. 42: 318-319. 1958.

During the spring of 1957 blackleg of tobacco, caused by Bacillus aroideae Townsend (Erwinia aroideae (Townsend) Holland), occurred in many plant beds and in some fields where diseased seedlings were transplanted. The symptoms of the disease are described. It is mainly a leaf and stalk disease of seedlings, but some of the roots of the plants were infected also.

37. NELSON, K. S. Studies on the relationship of the mineral salts supplied to two varieties of Dianthus caryophyllus and the resistance of the plants to the bacterial wilt organisms (Pseudomonas caryophylli). Abst. Doctoral Diss. Ohio State Univ. 67: 489-492. 1950-1951. (1958) (Biol. Abstr. D, 32: page 3504. 1958.)

Notes were made on pectic materials from the roots and stems of two varieties of carnation grown in sand culture with varied amounts of P, K, Ca, and Na available. Commercial saponin and carnation extracts were tested on goldfish and on Pseudomonas caryophylli. Both of these killed the goldfish. Effects of Pseudomonas were complex, with stem and root extracts of both carnation varieties inhibiting its growth in vitro. It is suggested that saponin in the carnation is a factor in effecting resistance to bacterial wilt, and that resistance is also related to the mineral nutrition.

38. PEAKE, R. W., M. W. CORMACK and R. K. DOWNEY. Evaluation of alfalfa for resistance to bacterial wilt in field and greenhouse tests. Can. J. Plant Sci. 38: 405-414. 1958.

Describes the application of improved methods to large-scale field and greenhouse tests of alfalfa for resistance to bacterial wilt, Corynebacterium insidiosum (McCull.) Jensen. In the field tests rooted cuttings or seedlings were inoculated by the bare-root soak method when planted in the field in May and by hypodermic injection of each root in the fall. In the following spring or fall the plants were cut off below ground with a special blade, pulled and individually evaluated for wilt resistance. In the greenhouse the root-ball soak method of inoculation was used and readings of seedlings were made after 3 months. Greenhouse tests were as reliable as those obtained in the field,

and were particularly useful for rapid screening of large populations. Field tests proved desirable for simultaneous studies on wilt resistance, growth habit, winter hardiness, and other qualities, and for final evaluation of potential variety material.

39. REPORT OF COMMITTEE. How can we interpret the zero tolerance for bacterial ring rot in certified seed potatoes? Am. Potato J. 34: 142-148. 1957. (Abstr. J. Sci. Food Agr. 9: i-25. 1958.)

The difficulties involved in obtaining potato seed pieces free from ring rot are described. Precautions for keeping fields free from ring rot and a programme for seed growers are outlined.

40. RIBALDI, M. and A. PANELLA. On bacterial wilt of alfalfa (Medicago sativa L.) caused by Corynebacterium insidiosum (McCull.) Jensen, in Italy. Euphytica 7: 179-182. 1958. (Rev. Appl. Mycol. 37: 732. 1958.)

In 1957 the authors found bacterial wilt (C. insidiosum) affecting 2- to 3-year old stands of lucerne in Bologna, Italy. A breeding program has been started, using resistant American material, and methods are being developed for testing resistance under Italian conditions.

41. RIBALDI, MARIO. Ricerche sul diradamento dei medicai italiani. I. Su una caratteristica alterazione di natura batterica dell'apparato radicale dell'erba medica (Medicago sativa L.). Phytopath. Z. 31: 337-366. 1958.

After a bibliographical survey of the bacterial diseases of leguminous forage plants, the author describes typical changes caused by bacterial infection in the roots of alfalfa plants that were showing initial stages of wilting. He describes two isolates of wilt bacteria as new species; namely Flavobacterium vasculorum Rib. and Aerobacter luteum Rib. Fusarium oxysporum Schlecht. was usually isolated from affected tissues of severely injured plants.

42. RICHARDSON, L. T. and C. T. BUCKLAND. Eradication of ring rot bacteria from contaminated potato bags by moist heat treatment. Plant Disease Reptr. 42: 241-245. 1958.

The effects of three different humidity levels in air at 70° C on the temperature and on the survival of the organism (Corynebacterium sepedonicum (Spieck. & Kott.) Skapt. & Burkh.) at various locations within a bale of jute bags were determined. The rate of heating of the jute and the mortality rate of the bacteria at each location was found to vary with the moisture content of the air. The mortality rate at each humidity level was highest at the center of the bale, decreased towards the surface and was lowest in the free space outside despite the reverse temperature gradient. This apparent anomaly is attributed to the original moisture content of the jute.

43. SEQUEIRA, LUIS. Bacterial wilt of bananas: Dissemination of the pathogen and control of the disease. Phytopathology 48: 64-69. 1958.

Pseudomonas solanacearum E. F. Sm. causes bacterial wilt of bananas, commonly known as Moko disease. Although infection can take place in the roots and spread from there into the foliage, this is not commonly the case. Most infections occur on the above-ground parts and dissemination occurs by pruning equipment and by infested soil lodging in wounds. The enforcement of a tool-disinfestation program gave almost complete control of the disease in experimental plots. Infested banana areas can be reclaimed successfully by a combination of disking five times during the dry season and fallowing for 9 months before replanting. The application of bactericidal chemicals was ineffective in eliminating the wilt organism from the soil.

44. SETH, J. and S. T. DEXTER. Root anatomy and growth habit of some alfalfa varieties in relation to wilt resistance and winter hardiness. Agron. J. 50: 141-144. 1958.

In these studies at Michigan State University the anatomy of five lucerne varieties resistant to wilt (Corynebacterium insidiosum) could in no way be differentiated from that of five susceptible ones.

45. SMITH, W. K. Chromatographic examination of the products of digestion of pectic materials by solution cultures of plant pathogenic and other bacteria. J. Gen. Microbiol. 18: 42-47. 1958.

Solutions containing pectic materials were digested by solutions from cultures of 25 bacteria and examined chromatographically for breakdown products. Galacturonic acid and oligouronides were found in the case of soft-rot Erwinia spp., Xanthomonas campestris, Pseudomonas marginalis, Bacillus polymyxa, and Klebsiella aerogenes (galacturonic acid only). Ability to produce enzymes capable of breaking down pectic substances to galacturonic acid and low oligouronides was found to be present in bacteria producing pectin methyl esterase.

46. SMITH, W. K. A survey of the production of pectic enzymes by plant pathogenic and other bacteria. J. Gen. Microbiol. 18: 33-41. 1958.

The soft-rot-causing species of Erwinia and two strains of Xanthomonas produced significant amounts of pectin methyl esterase, while 22 strains of pathogenic bacteria and 15 nonpathogens were found to produce $\gamma$-pectin glycosidase.

47. STARR, G. H. Potato ring rot information (as determined by a recent survey). Am. Potato J. 34: 264-268. 1957. (Rev. Appl. Mycol. 37: 307. 1958.)

This paper summarizes the results of a questionnaire on ring rot (Corynebacterium sepedonicum), addressed in July 1956 to workers in 17 potato-growing States of the U. S. A. and two Canadian Provinces.

48. STEINDL, D. R. L. "Bacterial mottle", a new disease of sugar cane in Queensland. Cane Gr. quart. Bull. 21: 6-8. 1957. (Rev. Appl. Mycol. 37: 182. 1958.

This disease of sugar cane has been called "root disease", owing to the poor development of the rooting system. The symptoms are described. The causal organism has been shown to be a bacterium, not yet identified, but possessing many characteristics of Erwinia. It is probably carried by flood waters.

49. VEKEMANZ, J. (Control methods for the enemies of tobacco and potato.) Bull. Inform. Inst. Etud. agron. Congo belge. 7: 1-29. 1958. (Rev. Appl. Mycol. 37: 447. 1958.)

The potato diseases reported from certain parts of the Belgian Congo are caused by Alternaria solani and by Pseudomonas solanacearum.

50. VOLCANI, Z. Soft rot on Japanese radish caused by a strain of Erwinia carotovora. Rec. agric. Res. Sta. Rehovot. 7: 141-142. 1957. (Rev. Appl. Mycol. 37: 127. 1958.)

Soft rot of Japanese radish growing in Cabri, south Israel, was caused by a non-gas forming strain of E. carotovora.

51. ZACHOS, D. G. The brown rot of potatoes in Greece. Ann. Inst. Phytopath. Benaki, N. S. 1: 115-117. 1957. (Rev. Appl. Mycol. 37: 676. 1958.)

Symptoms of this disease, which caused considerable damage, were recorded from central Greece in 1951, Naxos Island in 1953, and southern Peloponnese and the neighbourhood of Athens in 1957, the causal organism being identified in the last two cases as Pseudomonas solanacearum.

52. ANNUAL REPORT, DEPARTMENT OF AGRICULTURE, KENYA, 1955, Vol. II, 237 pp. 1957. (Rev. Appl. Mycol. 37: 135-136. 1958.)

Bacterial wilt (Pseudomonas solanacearum) was reported on tomatoes. A soft rot of Zantedeschia rhizomes was caused by bacteria, probably Bacterium carotovorum (Erwinia carotovora). A root and stem rot of cassava is reported to be associated with Coprinus sp. In tea nurseries a root disease attributed to Ganoderma sp. was discovered, which destroyed the lateral root system.

53. (THE FEDERAL AGRICULTURAL EXPERIMENT STATIONS, LAUSANNE. REPORT OF WORK IN 1956.) Annu. agric. Suisse, (71, ed. fr. 58), N.S. 7: 606-844. 1957. (Rev. Appl. Mycol. 37: 261-262. 1958.)

At Ependes one case of infection of potatoes by Erwinia atroseptica was noted. In an experiment with potato scab (Streptomyces scabies), PCNB at 90 kg/ha of active material, applied at a depth of 10 cm immediately before planting, markedly reduced infection in a plot in which beet had been grown previously, but was not effective where potatoes had been planted for 2 successive years. Tubers stored for 3 1/2 months after treatment at 60 or 90 kg/ha had an unpleasant odour and taste.

54. PLANT QUARANTINE ANNOUNCEMENTS. F. A. O. Plant Prot. Bull. 6: 27. 1957.

Federal Republic of Germany: It is prohibited to import potatoes infected with Corynebacterium sepedonicum.

55. PLANT QUARANTINE ANNOUNCEMENTS. F. A. O. Plant Prot. Bull. 5: 194; 6: 27-29. 1957. (Rev. Appl. Mycol. 37: 263-264. 1958.)

For the importation of potatoes into Norway an import license must first be obtained from the Ministry of Agriculture, and the consignment must be accompanied by a certificate from the Plant Protection Service of the country of origin that the potatoes are not infected by Corynebacterium sepedonicum and were grown in an area believed to be free from Synchytrium endobioticum.

56. PLANT QUARANTINE ANNOUNCEMENTS. F. A. O. Plant Prot. Bull. 6: 60. 1958.

New Zealand: Included among imports prohibited are potatoes, from all areas, that are infected by Corynebacterium sepedonicum.

57. PLANT QUARANTINE ANNOUNCEMENTS. F. A. O. Plant Prot. Bull. 6: 93-95. 1958.

Decree No. 263, published in La Gaceta, prohibits the importation into Nicaragua of cacao plants and parts from Panama, banana plants and parts from Honduras, where bacterial wilt (Pseudomonas solanacearum) has been found.

58. REPORT OF THE DEPARTMENT OF AGRICULTURE, N. S. W. FOR THE YEAR ENDED 30TH JUNE, 1956. 111 pp., 13 fig. 1957. (Rev. Appl. Mycol. 37: 133-134. 1958.)

Bacterial wilt (Pseudomonas solanacearum) was severe in tobacco seedbeds at Bourne. In control studies, improved Ceresan and phenyl mercuric nitrate gave the best control of the gladiolus corm diseases, bacterial scab (Pseudomonas marginata), Sclerotinia gladioli, and Botrytis rot.

## BIOLOGICAL CONTROL

59. CALDWELL, R. Fate of spores of Trichoderma viride Pers. ex Fr. introduced into soil. Nature 181: 1144-1145. 1958.

In the course of an ecological study of Trichoderma viride Pers. ex Fr., observations have been made on the survival and germination of its conidia and chlamydospores in soil. The results show that in the soil types used, T. viride survives for considerable periods both as chlamydospores and conidia, and that there is a low rate of germination of these spores.

60. FEDORINCKIK, N. S. and L. K. VANDORFLAAS. (Effect of the antagonistic activity of the soil fungus Trichoderma lignorum Harz on increase in yields of agricultural crops.) Trud. vsesoyuz. Inst. Zashch. Rast., 5: 17-37. 1954. (Rev. Appl. Mycol. 37: 24. 1958.)

In a series of pot and field experiments in the U. S. S. R. the introduction of T. lignorum into sterilized soil inhibited the growth of a number of fungus pathogens on several different hosts.

61. FEDOTOVA, T. I. (The influence of silicate bacteria on the susceptibility to diseases and yield of plants.) Plant Prot. Moscow, 1957, 3: 45-46. 1957. (Rev. Appl. Mycol. 37: 571-572. 1958.)

Introduction of silicate bacteria into the soil reduced rusts on wheat and barley, loose smut on maize, Ascochyta and a bacteriosis on peas, Fusarium (oxysporum) and a bacteriosis on lupin, and cucumber bacteriosis (Pseudomonas lacrymans), decreasing the diseases 2-3 times and increasing yields 20-30 percent. The same treatment against Fusarium (lini) on flax reduced infection to 7 percent and increased yield 16 percent.

62. FEDOTOVA, T. I. and E. F. KARASEVA. (The role of immune potatoes in soil disinfection from wart disease.) Plant Prot. Moscow, 1957 (5): 45-46. 1957. (Rev. Appl. Mycol. 37: 593. 1958.)

At the Litovskiy Experiment Station for Potato Diseases and Pests, trials showed that the varieties Fram, Puntukas, and Imandra resistant to Synchytrium endobioticum, were useful for freeing the soil from infection. After the crop 1 g of soil contained 4-18 zoosporangia compared with 453 in soil planted with the susceptible variety Valley.

63. GANDEL'MAN, T. C. (Agrotechnical measures against potato wart.) Potato, Moscow, 1958 (2): 44-46. 1958. (Rev. Appl. Mycol. 37: 593. 1958.)

In co-operative studies in U. S. S. R. on wart disease (Synchytrium endobioticum), it was found that infested soil was almost or completely cleared by planting rye, lupins, cabbage, maize, flax, or resistant potato varieties for at least 3 years; cabbage gave 100 percent control.

64. GARRETT, D. S. Inoculum potential as a factor limiting lethal action by Trichoderma viride Fr. on Armillaria mellea (Fr.) Quél. Trans. Brit. Mycol. Soc. 41: 157-164. 1958. (Rev. Appl. Mycol. 37: 649. 1958.)

Woody inocula of A. mellea were incubated for 23 days at 21°-24° C in autoclave-sterilized soil containing pure cultures of T. viride or Penicillium wortmannii, also dilutions of these with unsterilized soil to 1/4, and (with T. viride) to 1/8 strength. The inocula were then brushed clean and set in soil growth tubes, and the subsequent rhizomorph production by A. mellea over a period of 76 days was measured. The results indicated a significant correlation between the inoculum potential of T. viride and its lethal effect on A. mellea.

65. GRASSI, G. V. The biological control of Verticillium albo-atrum R. and B. by various antagonistic organisms. Diss. Abstr. 17: 1449. 1957.

At Purdue University it was observed that soil amendments stimulated the development of various saprophytes, which multiplied at the expense of pathogens, preventing their growth. The evidence showed that the incidence of wilt is related to the number of antagonistic organisms present in muck soil. These were isolated and, when introduced singly into soil inoculated with V. albo-atrum plus various amendments to stimulate the development of the antagonists, gave excellent control.

66. GRIFFITHS, E. and M. A. SIDDIQI. Microbial antagonism of Fusarium culmorum. Nature 182: 956. 1958.

In studies on the pathogenicity of Fusarium culmorum towards rye-grass a bacterium was found to be regularly present on the root surfaces, particularly of healthy roots. This bacterium was proven to be very antagonistic towards Fusarium culmorum, and to prevent pathogenic action of the Fusarium on roots protected by the bacterium. The bacterium possessed the typical morphology and flagellation of a Pseudomonas, and the biochemical reactions of Klebsiella aerogenes.

67. KUBLANOVSKAJA, G. M. and V. M. DŽALILOVA. Biological control of fusarium wilt on melons. Sad. i Ogorod, No. 2: 41-46. 1958. (Hort. Abstr. 28: 409. 1958.)

Two strains of actinomycetes (No. 935 and 1699) antagonistic to Fusarium oxysporum were used in pot experiments and small scale field trials. In the pot experiments germination of melon seed was stimulated by application, 10 days before sowing, of oil cake at 2 t. per ha or oil cake plus actinomycetes

at 3 t. per ha, the latter being considerably more effective. In the field trials the actinomycetes-oil cake fertilizer was used in split applications. The greatest reduction of infection was obtained from two applications, but the highest yield did not coincide with the lowest disease incidence, indicating that the actinomycetes possess not only antibiotic but also growth stimulating properties.

68. MIRZABEKYAN, R. O. and N. V. SINITSUINA. (Tests with actinomycetes against potato wart.) Plant Prot., Moscow, 1957 (5): 42-44. 1957. (Rev. Appl. Mycol. 37: 593. 1958.)

In investigations at the Academy of Sciences, Moscow, on actinomycete strains antagonistic to Synchytrium endobioticum, strain No. 167 and to a lesser extent 711 were the most active.

69. MOSKOVETS, S. N. (Cotton wilt and methods for its control in the Ukraine.) Trud. ukr. nauch.-issled Cotton Inst., Zashch. Rast., Kiev, 1956, pp. 46-55. 1956. (Rev. Appl. Mycol. 37: 537. 1958.)

In a comparative study in the Ukraine and Azerbaijan the incidence of Verticillium dahliae in cotton grown in a field previously planted with lucerne and certain cereals for at least 2 years was only 0.5-3.7 percent compared with 25-97.2 percent in fields previously bearing other crops. Applications of K increased resistance. A spacing of 70 x 10 cm per plant proved the best.

70. PARK, DAVID. Behaviour of soil fungi in the presence of bacterial antagonists. Trans. Brit. Mycol. Soc. 40: 283-291. 1957. (Biol. Abstr. 32: 2092. 1957.)

Selected native soil fungi and alien fungi were compared in their reactions to bacterial antagonism. In agar and liquid cultures there was no distinction between the two categories. In sand and soil cultures containing a mixed bacterial flora, differences in behavior were observed. In these artificial situations, the distinctions were not between alien fungi and fungi native to a particular soil, but between soil inhabitants generally, and fungi from other sources. The exochthonous fungi which remained viable in those cultures allowing of comparison did so solely by means of inhibited spores, whereas the soil inhabitants spread throughout the substratum as a mycelium, some cells of which persisted.

71. PARK, DAVID. Behaviour of soil fungi in the presence of fungal antagonists. Trans. Brit. Mycol. Soc. 40: 358-374. 1957. (Biol. Abstr. 32: 2092. 1958.)

Soil-inhabiting fungi were compared with exochthonous fungi in their reaction to fungal antagonism. In certain cultures containing fungi of both categories, the soil-inhabiting fungi became dominant, and subsequently demonstration of the presence of the exochthonous fungi became impracticable. Under conditions of antagonism that inhibited the growth of soil-inhabiting fungi, spores of exochthonous fungi remained demonstrable. The lack of success of exochthonous fungi under conditions permitting fungal growth is accounted for by the greater activity of the soil-inhabiting fungi. In a discussion of tolerance it is suggested that the effect of environment on survival of soil fungi is related to their tolerance for activity rather than to their total tolerance.

72. SERGEEV, L. A. (On a biological method for the control of Flax wilt.) Zashch. Rast., Kiev, 1956, pp. 56-62. 1956. (Rev. Appl. Mycol. 37: 355-356. 1958.)

In a study of the microflora of the rhizosphere of flax in southern Ukraine 25 strains of 9 species were isolated. Cultures on sterile oats were introduced into the soil in the field, together with flax seeds, to determine their antibiotic activity against Verticillium dahliae. Previously the soil had been inoculated with cultures of V. dahliae. The antibiotic fungi reduced infection from 44.4 to 32.2 percent. Some strains not only decreased the disease but increased yield.

73. SHOPINA, V. V. The role of the preceding crops with respect to the change of susceptibility of wheat to brown rust. Doklady vsesoyuz. Akad. Selskokhoz. Nauk im V. I. Lenina 22: 34-36. 1957. (Chem. Abstr. 52: 3927. 1958.)

The preceding crop was either cotton, sunflowers, or Indian corn. Wheat following corn will not be so heavily attacked by the rust. This may be explained by the amounts of P, K and N removed by the preceding crops from the soil or left there (analyses of plant parts are presented). Wheat following sunflowers contained more K in the leaves than any other wheat in these experiments.

74. TUPENEVICH, S. M. (Suppression of the parasitic activity of the fungus Rhizoctonia solani Kühn as the causal agent of black scurf of potato.) Trud. vsesoyuz. Inst. Zashch. Rast., 5: 5-16. 1954. (Rev. Appl. Mycol. 37: 54. 1958.)

In experiments in the U. S. S. R. black scurf of potatoes (R. (Corticium) solani) was successfully controlled by planting after winter wheat.

75. VAARTAJA, O. Effect of Trichoderma on tree seedlings and their pathogens. Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can., 13: 1. 1957.

Trichoderma strains isolated from tree seedlings were potentially pathogenic to seedlings of Pinus spp., Betula spp., and Caragana arborescens, especially in weak light, and they differed in pathogenicity. Each of 11 strains reduced the growth of Rhizoctonia (Corticium) solani at a distance of several cm; when the Trichoderma colonies met those of C. solani, they overgrew the latter. When seedlings of Pinus banksiana were grown in pots in different soils inoculated with two Trichoderma strains, the fungus appeared to increase the survival of the seedlings. It is suggested that the moderately phytotoxic and strongly antifungal antibiotics known to be produced by Trichoderma may accumulate only under certain conditions.

76. YIN, S. Y., et al. A further study on the biological control of Verticillium wilt of cotton. Acta phytopath. sinica, 3: 55-61. 1957. (Rev. Appl. Mycol. 37: 168. 1958.)

At the Liaoyang Cotton Experimental Station antagonistic actinomycetes cultured on cotton seed cake used as fertilizer stimulated the growth of cotton plants and decreased Verticillium wilt. Isolates G4 and 5406 gave best results; three applications of the fertilizer containing them resulted in a decrease of 31-50 percent in the disease and an increase of 14-40 percent in yield.

77. YIN, S. Y., et al. A preliminary study on the selection and culture of antagonists for some cotton disease organisms with reference to their field performance. Acta phytopath. sinica, 1: 101-114. 1955. (Rev. Appl. Mycol. 37: 43. 1958.)

Of 1205 actinomycetes isolated during 1950-54 in various parts of China, 42.7 percent were antagonistic to Verticillium albo-atrum, 35-45 percent to Fusarium vasinfectum, 25.2 percent to Rhizoctonia solani, and 33.2 percent to Pythium spp., all infecting cotton. The slowly sporulating isolates were generally the most active and those antagonistic to C. solani were usually highly antagonistic to the other fungi.

78. THIRTY-SEVENTH REPORT OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY, CAMBRIDGE, 1956. -- 60 pp., 1957. (Rev. Appl. Mycol. 37: 2-3. 1958.)

In further studies on the interaction of Rhizoctonia (Corticium solani) and Phytophthora infestans on potato tubers, C. solani inoculated on tubers and on artificial media caused disorganization and the eventual disappearance of P. infestans. The addition of a liquid exudate from C. solani to a zoospore suspension of P. infestans caused cessation of movement and dissolution of the zoospore membrane in 30 minutes.

## CONTROL

### Control -- Crop Manipulation

See also 124, 353

79. LOUW, H. A. The effect of various crop rotations on the incidence of take-all (Ophiobolus graminis Sacc.) in wheat. Sci. Bull. Dept. Agric. S. Afr. 379, 12 pp. 1957. (Rev. Appl. Mycol. 37: 714. 1958.)

The increased microbial activity in the soil, brought about by crop rotation (legumes-wheat), was found to aggravate rather than suppress the incidence of take-all, contrary to Garrett's findings, but although positively correlated with microbial activity, its incidence is also subject to other factors.

80. LOUW, H. A. Microbiological analysis of a Western Cape Province grain soil under various crop rotations. Sci. Bull. Dept. Agric. S. Agr. 378, 36 pp. 1957. (Rev. Appl. Mycol. 37: 714. 1958.)

A microbiological analysis carried out under four different crop rotation systems indicated that microbial activity was highest in legume-wheat plots, but so also was the incidence of take-all (Ophiobolus graminis).

### Control -- Miscellaneous

81. ANTOINE, R. La production de boutures saines dans la lutte contre la maladie du rabougrissement des repousses de la Canne à sucre à l'Île Maurice. (The production of healthy cuttings in the control of ratoon stunting disease of Sugar-cane in Mauritius.) Rev. agric. sucr. Maurice (formerly Rev. agric. Maurice) 37: 8-13. 1958. (Rev. Appl. Mycol. 37: 677. 1958.)

The methods for control of this disease are presented in detail. There are three main features, production of resistant varieties, prophylactic treatment of implements, and hot water treatment of cuttings, the apparatus for carrying out the last on a large scale being described.

82. BAKSHI, B. K. Wilt disease of Shisham (Dalbergia sissoo Roxb.). IV. The effect of soil moisture on the growth and survival of Fusarium solani in the laboratory. Indian For. 83: 505-511. 1957. (Rev. Appl. Mycol. 37: 117. 1958.)

Studies suggest that F. solani on Dalbergia sissoo may be controlled by irrigation. The fungus grew and survived well in sterile loam soil with 20 percent moisture, but above this there was a sharp decline until contamination was eliminated with free water.

83. KON'KOVA, R. D. (Irrigation in the control of potato wilt.) Sborn. Trud. Yuzh, N. I. Inst. hydrotech. melior., 1956, 4: 247-252. 1956. (Abstr. from Referat. Zh. Biol., 1958, 2: 195. 1958.) (Rev. Appl. Mycol. 37: 504. 1958.)

In the Stavropol' region, U. S. S. R., the wilt of potatoes caused by Fusarium oxysporum and physiological disturbances was checked very successfully by maintaining the soil moisture at no less than 85 percent during flowering and 80 percent afterwards.

84. RUSSELL, R. C. and S. H. F. CHINN. The salt-water soak treatment for the control of loose smut of barley. Plant Disease Reptr. 42: 618-621. 1958.

The soaking of barley seed in weak saline solutions was just as effective in controlling loose smut caused by Ustilago nuda (Jens.) Rostr. as the water soak treatment, and interfered much less with the germination of the seed.

85. STANKOVA-OPOCENSKA, E. (Aster wilt. I. A contribution to the biology of the causal organism of aster wilt (Fusarium conglutinans var. callistephi). II. A survey of the most suitable methods of control.) Sborn. csl. Akad. zemed. Ved, Rostl. Vyroba, 30: 727-740, 741-748. 1957. (Hort. Abstr. 28: 271. 1958.)

Soaking aster seeds for 30 minutes in a 0.1 percent solution of mercuric chloride controlled wilt but reduced germination. Steam sterilization of

the soil prevented infection for 3-4 weeks and stimulated growth. Carnations appeared to be an unsuitable preceding crop. Acti-dione reduced infection and stimulated germination.

86. TAMAQO, B. P. and F. T. ORILLO. Seed treatment of vegetables for control of damping-off. Philippine Agriculturist 40: 519-523. 1957. (Chem. Abstr. 52: 4090. 1958.)

At dosages of 0.5 percent by weight of Chinese cabbage seeds, Granosan (I) and Semesan (II) dusts applied for damping-off control increased emergence of the seedlings, and Spergon increased the emergence of cabbage and eggplant seedlings. (I), (II), and Arasan SF-X injured lettuce seedlings. (I) and Crag 5400 were high in protective value especially on cucumber seedlings. The authors were unable to obtain satisfactory protection against post-emergence damping-off.

87. TARR, S. A. J. Control of seed-bed losses of groundnuts by seed treatment. Ann. Appl. Biol. 46: 178-185. 1958. (Rev. Appl. Mycol. 37: 695. 1958.)

Fungicidal treatment of groundnut seed was conducted under rainfall in the sandy soils of west-central Sudan and under irrigation in the alkaline clay soils of the Gezira. The benefits were greatest with slightly damaged seeds but also occurred even when selected, undamaged seed was sown by hand. Organisms involved included Aspergillus niger, A. flavus, and Rhizopus spp.

88. TYNER, L. E. The effect of water on the partial sterilization of barley seed by propylene oxide and by heat. Phytopathology 48: 177-178. 1958.

Three of the four genera of the fungi recorded on barley seed were eliminated satisfactorily by propylene oxide from either dry or moistened seed. Control of fungi was not effected by any heat treatment of the dry seed but the addition of moisture greatly facilitated their elimination. Rhizopus spp. were the most difficult to control but at 55° or 60° C they were fairly successfully eliminated from seed to which 20 or 30 percent water had been added.

## FUNGI

See also 31, 52, 77, 381

89. ASHOUR, W. A. and M. M. EL-KADI. Damping-off disease of tomato seeds and its control. Ann. agric. Sci., Cairo, 1: 111-126. 1956. (Arabic summary.) Rev. Appl. Mycol. 37: 739-740. 1958.)

Fusarium semitectum, Rhizoctonia solani, and Alternaria tenuis were isolated from damped-off seedlings, F. semitectum mostly from unemerged and R. solani from diseased seedlings.

90. ASHOUR, W. A. Effect of watering treatment, seed treatment and date of sowing on emergence and damping-off of cotton seeds. Damping-off disease of cotton. 1 -- Studies of the causal organisms and their pathogenicity. Ann. agric. Sci., Cairo, 1: 161-176. 1956; 2: 81-94. 1957. (Rev. Appl. Mycol. 37: 721-722. 1958.)

Fusarium vasinfectum was isolated most frequently from damped-off cotton seeds, but Rhizoctonia (Corticium) solani, not present in winter, was most pathogenic; Mucor sp., Rhizopus nigricans, Pythium debaryanum, and Stemphylium sp. were also isolated. All were seed-borne. Emergence was better with all 6 present in the soil than with one alone. Of 7 fungicides tested in the first study and 9 in the second, 1 percent fernasan seed dressing was most effective in increasing the percentage of survival, but it had no effect on post-emergence damping-off. Different methods of irrigation had no effect.

91. ASTHANA, R. P. Incidence of wilt disease (on Linum usitatissimum in M. P.). Nagpur agric. Coll. Mag. 31 (1-4): 16-17. 1956-7. (Rev. Appl. Mycol. 37: 285. 1958.)

Wilted linseed plants contained either Fusarium sp. or Rhizoctonia sp. Seed-inoculation experiments over a period of 7 years showed that the Fusarium sp. alone caused 76.08 percent wilting, Rhizoctonia alone 10.4

percent, and a half-and-half mixture of both 50.83 percent. Treatment of seed with mercury compounds, particularly Ceresan, reduced wilting, which is most severe in a late crop.

92. BIANCHINI, C. L. Las llagas del café en Costa Rica. (The cankers of coffee in Costa Rica.) Bol. tech. Min. Agric. Industr. Costa Rica 21, 27 pp. 1958. (Rev. Appl. Mycol. 37: 660. 1958.)

For black canker Rosellinia ? bunodes was found to be responsible, but a Fusarium sp. was frequently associated with it. White root cankers yielded Trichoderma sp., Rosellinia sp., and an unidentified jade green fungus; the pathogenicity of all was confirmed. The disease is attributed to their combined action. The principal agent of ulcerated root canker was a Curvularia sp., though Fusarium oxysporum f. coffeae was frequently isolated and its pathogenicity established. A reddish brown rot of the stem base of 1-2-year old plants was caused by Cylindrosporium sp., Fusarium oxysporum, and Tuberculariа sp.

93. BÖNING, K. Starkes Auftreten von Schwärze an Getreide. (Extensive occurrence of blackening of cereals.) Pflanzenschutz 9: 115. 1957. (Rev. Appl. Mycol. 37: 29-30. 1958.)

An etiological connection between black mould (Cladosporium herbarum) and foot rot (Ophiobolus graminis) is postulated where they have occurred together on cereals in Germany.

94. BRIEN, R. M., et al. Diseases and pests of lettuce in New Zealand and their control. Inform. Ser. Dep. Sci. industr. Res. N. Z. 14, 38 pp. 1957. (Rev. Appl. Mycol. 37: 436. 1958.)

Damping-off, both pre- and post-emergence, due to Pythium spp. and Rhizoctonia (Corticium) solani, is reported. Among the bacterial diseases is included soft rot caused by Erwinia carotovora.

95. BUNKINA, I. A. Diseases of ginseng and their control. (Plant Prot., Moscow), 1957, 4: 39-40. 1957. (Rev. Appl. Mycol. 37: 498-499. 1958.)

Pathogens of ginseng in the Primorye, U. S. S. R., where the crop has recently been introduced, include Phytophthora cactorum, Colletotrichum panacicola, Alternaria panax, Fusarium spp., Rhizoctonia (Corticium) solani, and Ramularia spp., all of economic importance. Irrigation and choice of planting sites are poor and there are heavy losses in fields exposed to the sun. Against Fusarium spp. and C. panacicola seed treatment for 15 minutes in 0.25 percent calcium permanganate or 40 percent formalin (1:300) proved effective and did not reduce germination; the best results, however, were obtained with NIUIF-DRB and thiram on the seed, and soaking the roots of seedlings for 15 minutes in 1 percent Bordeaux or 0.25-0.3 percent calcium permanganate before transplanting gave very good control.

96. CHEVAUGEON, J. and A. RAVISÉ. Régime de l'eau et maladies parasitaires du riz en Afrique Occidentale. (Water regime and parasitic diseases of rice in West Africa.) Jour. Agric. Trop. et Bot. Appliquée 4: 143-151. 1957. (Biol. Abstr. 32: p. 2670. 1958.)

The most economical and rapid way of combating plant diseases is to change the environment harboring the pathogens. The paucity of water in the Senegal region and the excess of water in the Ivory Coast are both responsible for parasitic diseases of rice. In Senegal, Fusarium nivale was among the most important, including species of Rhizopus, Helminthosporium, Curvularia, and Phyllostica, among the 263 species of fungal organisms. The number of seedlings killed by pathogenic fungi is small. Even under the most favorable conditions less than 5 percent of plants are attacked. The major cause of seedling mortality was found to be anaerobiosis when seeds were planted in deep water.

97. CONNERS, I. L., R. A. SHOEMAKER, and D. W. CREELMAN. Thirty-sixth Annual Report of the Canadian Plant Disease Survey, 1956. --XXIX + 134 pp. 1957. (Rev. Appl. Mycol. 37: 205-206. 1958.)

Severe damage was caused to soybeans in southwestern Ontario by an undetermined sp. of Phytophthora, causing a root and stalk rot. Club root (Plasmodiophora brassicae) is spreading on Cruciferae in Canada. A canker of parsnips (Itersonilia perplexans) is reported for the first time from Canada in Pell County, Ontario. During the hot dry season of 1955 the pathogen isolated most frequently from white beans (Phaseolus vulgaris) affected by root rot in southwestern Ontario was Fusarium oxysporum, whereas in 1956, a cool wet season, F. solani f. phaseoli predominated.

98. CRAIG, J. and B. KOEHLER. Pyrenochaeta terrestris and Phaeocytosporella zeae on corn roots. Plant Disease Reptr. 42: 622-623. 1958.

At Urbana, Illinois, eight species of fungi isolated from the roots of field corn with red root rot were tested for pathogenicity to dent corn seedlings in pots of infested soil in the greenhouse. Phaeocytosporella zeae and Pyrenochaeta terrestris were the only species causing extensive and consistent root rot, and P. terrestris was the only one that induced red discoloration.

99. DARPOUX, H., J. PONCHET and M. GUNTZ. Problèmes de pathologie végétale intéressant des régions à sol granitiques. (Interesting problems of plant pathology in areas with granitic soils.) Rev. Path. gén. 1957, pp. 843-853. 1957. (Rev. Appl. Mycol. 37: 455. 1958.)

The seriousness of club root (Plasmodiophora brassicae) of crucifers, potato scab (Streptomyces scabies), and take-all (Ophiobolus graminis) of Gramineae on certain granitic soils in Brittany is considered in relation to pH and to control methods.

100. DECKER, P. and S. A. OSTAZESKI. In Ann. Rept. of Agr. Experiment Stations, Florida, for year ending June 30, 1957. (Rev. Appl. Mycol. 37: 699-700. 1958.)

Root rots were important on yellow and blue lupins (Lupinus luteus and L. angustifolius); isolates from affected roots of both were Rhizoctonia and Fusarium spp., but in limited tests only Rhizoctonia spp. were pathogenic to blue lupin seedlings.

101. DRAKE, CHARLES R. Diseases of birdsfoot trefoil in six southeastern States in 1956 and 1957. Plant Disease Reptr. 42: 145-146. 1958.

Root rots of birdsfoot trefoil caused by Fusarium spp. and Verticillium spp. attacked plants principally in spaced-plant nurseries.

102. EBBEN, MARION H. In Annual Report 1956, Glasshouse Crops Research Institute. 139 pp. 1958. (Rev. Appl. Mycol. 37: 633-634. 1958.)

Describing investigations into carnation wilt diseases (Verticillium cinerescens, Fusarium roseum, F. oxysporum f. dianthi, and Erwinia sp.) Marion H. Ebben states that F. roseum by itself frequently causes wilt. Acti-dione in agar completely inhibited the growth of V. cinerescens and greatly retarded that of F. roseum. Secondary infection of wilted plants commonly occurs, especially after cortical rotting by F. roseum. The slow development of wilt organisms within the plant handicaps prevention of the disease in carnations.

103. FEZER, K. D. A study of factors that influence survival of red clover, with special reference to root rots. Diss. Abstr. 17: 939. 1957. (Rev. Appl. Mycol. 37: 100. 1958.)

At Cornell University the fungi most frequently isolated from diseased roots of red clover were Fusarium solani, F. oxysporum, and Gliocladium sp., in that order. F. solani was pathogenic to seedlings and to both young and mature plants. It seems that all these fungi contribute to failure of red clover to survive more than 2 years in New York. In the greenhouse, treat-

ments which weakened the plants favored the development of tap root infection. Plants persisted longer in fields fumigated with methyl bromide.

104. FULTON, N. D. and K. BOLLENBACHER. Pathogenicity of fungi isolated from diseased cotton seedlings in Arkansas. (Abstr.) Phytopathology 48: 343. 1958.

Of 22 fungous isolates tested for pathogenicity on cotton seed and seedlings in the greenhouse and laboratory, Rhizoctonia solani and Pythium sp. caused the most pre-emergence killing. Most isolates were more pathogenic in tests held constantly at 21° C than at 27° C for 1 week and then changed to 16° C.

105. FULTON, ROBERT H. New or unusual small fruit diseases and disease-like occurrences in Michigan. Plant Disease Reptr. 42: 71-73. 1958.

Red stele of strawberry caused by Phytophthora fragariae was found for the first time in Michigan, in the variety Fairland which has previously been regarded as a red stele-resistant variety. Evidence was adduced that Armillaria mellea (Vahl) Quél. was responsible for a root rot of the highbush blueberry (Vaccinium australe). As blueberry is not indicated as a host of Armillaria, this is believed to be the first record for this fungus on this host.

106. GOMOLYAKO, M. I. (Fungi on the roots of spring wheat.) J. Microbiol., Kiev, 18 (3): 12-24. 1956. (Rev. Appl. Mycol. 37: 655. 1958.)

At the Microbiological Institute, Ukraine, 29 fungi were isolated in field and laboratory tests from the rhizospheres and roots of the spring wheat varieties Odessa 13, Melyanopus 69, and Narodna. Only Helminthosporium bondarzewi, Alternaria sp., H. sativum, and Pyrenochaeta sp. caused damage. Rhizoctonia solani did not penetrate the roots and is not considered dangerous. Further investigations may show that Cladosporium spp. are even beneficial.

107. GRANT, U. J. et al. (How to increase maize production in Colombia.) Bol. Dep. Invest. agropec., Bogotà, 1, 51 pp. 1957. (Rev. Appl. Mycol. 37: 279-280. 1958.)

Rots of the cob and roots of corn caused by species of Fusarium, Diplodia, Gibberella, and Pythium are responsible for considerable damage, though there are resistant varieties.

108. GROVES, A. B. Root diseases of deciduous fruit trees. Bot. Rev. 24: 25-42. 1958.

The article reviews work of the past decade in this field. It is a decennial supplement to Cooley, J. S. Root Diseases of Deciduous Fruit Trees. Bot. Rev. 12: 83-100. 1956. Fields of investigative efforts given a more extended treatment than offered earlier include replant problems, virus and nematode diseases, and non-parasitic disorders.

109. HAWN, E. J. Studies on crown bud rot of alfalfa in southern Alberta. Diss. Abstr. 17: 939-940. 1957. (Rev. Appl. Mycol. 37: 101. 1958.)

The main advance of the disease in each year occurs during the first month of active growth. Temperatures above 16° C arrest the development of the disease. The most pathogenic of isolates from crowns to crown buds were Rhizoctonia solani, Fusarium avenaceum, F. acuminatum, and Ascochyta imperfecta, in descending order. F. acuminatum was the predominant fungus until the third year, when its numbers were approximately equalled by C. solani. The later decline of C. solani coincided with a reduction in the rate of development of the disease. F. acuminatum appears to be equally active throughout the growing season, whereas C. solani generally appears most frequently in summer samples.

110. HAWN, E. J. Studies on the epidemiology of crown bud rot of alfalfa in southern Alberta. Can. J. Botany 36: 239-250. 1958.

Crown bud rot is widespread in irrigated alfalfa stands in southern Alberta. Rhizoctonia solani Kühn, Fusarium roseum Link sensu Snyder &

Hansen, and Ascochyta imperfecta Peck, acting alone or in combination produce brown to black lesions on the crown buds of plants in their second and subsequent years of growth. The host plant is most susceptible to the disease in early spring after winter dormancy.

111. HORTON-SMITH, C. (Edit.) Biological aspects of the transmission of disease. 179 pp., Edinburgh and London, Oliver and Boyd, 1957. (Rev. Appl. Mycol. 37: 10. 1958.)

In a symposium on biological aspects of the transmission of disease, organized in London by the Institute of Biology, papers of phytopathological interest included: a discussion of "The soil as a reservoir of pathogenic micro-organisms" and of root-infecting fungi in particular by S. D. Garrett.

112. IVANCHENKO, Y. N. (The causes of oak wilt in the Lipetsky garden in the Saval'sky Forest.)Trud. vsesoyuz. Inst. Zashch. Rast., 1957, 8: 221-225. 1957. (Rev. Appl. Mycol. 37: 742. 1958.)

Ophiostoma roboris, O. valachicum, O. kubanikum, and Fusarium sp. were isolated from wilted oak trees. Their pathogenicity was established by inoculation separately into healthy trees, each strain being recovered after 8 days from the superficial lesions formed. Typical wilt occurred only in trees inoculated with all four fungi. Scolytus intricatus appeared to be a carrier.

113. KENDRICK, J. B. Jr. and A. R. JACKSON. Factors influencing the isolation of certain soil-borne plant pathogens from soil. (Abstr.) Phytopathology 48: 394. 1958.

The presence of certain soil-borne plant pathogens is difficult to detect by soil-dilution techniques. Plating corn seed on water agar after incubation in soil has proved successful in trapping Pythium, Rhizoctonia, Fusarium, and Sclerotium spp. as well as certain other fungi. Soil moisture, temperature, and incubation period, however, influence the kinds and percentage recoveries of these fungi.

114. MACHACEK, J. E. Prevalence of Helminthosporium sativum, Fusarium culmorum and certain other fungi in experimental plants subjected to various cultural and manurial treatments. Can. J. Plant Sci. 37: 353-365. 1957. (Rev. Appl. Mycol. 37: 265. 1958.)

During 7 years of sampling 62 genera of microfungi were found in the soil of experimental plots. The five saprophytic species Aspergillus flavipes, Penicillium chrysogenum, P. intricatum, P. restrictum, and P. terrestre accounted for 52.7 percent of the colonies isolated. Fusarium culmorum and Helminthosporium sativum (Cochliobolus sativus) made up only 0.5 percent. Soil temperature and rainfall had no effect on the number of these and other fungus colonies, neither did crop rotation nor soil fertilization.

115. MESSIAEN, C. M. (Sugar content of maize stalks and parasitic lodging.) Rev. Path. veg. 36: 209-213. 1957. (Rev. Appl. Mycol. 37: 407. 1958.)

The author attempted to ascertain correlation between the lack of sugars in the roots of maturing maize plants and the susceptibility of roots and stalks to fungi causing lodging. Fungi used for inoculations were Colletotrichum graminicola, Gibberella zeae, and Phaeocytosporella zeae. Results showed clearly that resistance to infection occurs when the sugar content is over 5 percent.

116. MORWOOD, R. B. Notes on plant diseases listed for Fiji. Agric. J. Fiji 27: 83-86, 1956. (Rev. Appl. Mycol. 37: 204. 1958.)

Phytophthora palmivora causes serious fruit and root rots of papaw. Panama disease (Fusarium oxysporum f. cubense) of banana, previously recorded in Fiji, has not been seen by the writer. Heavy losses of potato crops are caused by Fusarium wilt (F. oxysporum) and other diseases.

117. NELSON, PAUL E. Pathogenic soil fungi and diseases they cause. Florists' Exchange, 130 (2): 13, 48-49. 1958.

118. NOORDAM, D., D. P. TERMOHLEN and T. H. THUNG. Corky root symptoms of tomato caused by a sterile mycelium. Tijdschr. Plantenziekten 63: 145-152. 1957. (Biol. Abstr. 32: 875. 1958.)

A sterile fungus isolated from sieved and centrifuged corky root powder was mixed with silversand or sterilized soil. Tomatoes planted in pots filled with these mixtures showed symptoms of corky roots. From 39 out of 65 root pieces the same fungus was re-isolated.

119. PAPAÏOANNOU, A. J. Notes phytopathologiques. I. II. Ann. Inst. phytopath., Benaki, 8: 96-102. 1954; 10: 22-27. 1956. (Rev. Appl. Mycol. 37: 133. 1958.)

Diseases new to Greece included wilt of pistachio nut, believed to be caused by Fusarium sp. but also associated with Verticillium albo-atrum as a secondary invader.

120. PLANT PATHOLOGY DIVISION. Res. and exp. Rec. Minist. Agric. North Ireland 5 (1955): 129-151. 1957. (Rev. Appl. Mycol. 37: 3-4. 1958.)

Red core (Phytophthora fragariae) is now an acute problem in the strawberry-growing districts of County Armagh, where the problem will be to replace the susceptible variety Climax by another resistant to the disease. Over 20 cases of foot rot (Phytophthora cryptogea) of tomato were recorded, the earliest sample being encountered on April 20. Fusarium caeruleum and, to a lesser extent, Fusarium avenacearum were mainly responsible for dry rot of potato. F. culmorum and Cylindrocarpon radicicola also cause the condition on occasion. Crown gall (Bacterium (Agrobacterium) tumefaciens) of garden beet was reported in County Londonderry. In mid-October, 1955, 20 percent of a recently lifted and severely scabbed (Actinomyces (Streptomyces) scabies) crop of Stormont Dawn potato in County Armagh exhibited a marked proliferation of the sprouts, with cauliflower-like growths, simulating wart disease, at the rose end of the tuber. This was not necessarily due to the scab caused by S. scabies.

121. PLANT PATHOLOGY DIVISION. Res. and exp. Rec. Minist. Agric. North Ireland, 6 (1956): 158-181. 1957. (Rev. Appl. Mycol. 37: 324-326. 1958.)

Fusarium culmorum, F. sambucinum, and F. tricinctum are recorded as causing occasional rots of potato tubers. The greater prevalence of rots caused by F. caeruleum is thought to be related to its more frequent occurrence in the field and ability to infect tubers under conditions of low humidity. Five isolates of F. avenaceum from seed oats were pathogenic to potato tubers. In general, susceptibility to dry rot increases with age and is unaffected by slight variations in the storage temperature. Fusarium caeruleum on potatoes is easily spread by a cutting knife and may also enter the tuber through common scab (Streptomyces scabies) lesions. In experiments on the effect of nutrition in relation to club root (Plasmodiophora brassicae), the disease index fell as the dosage of ammonium sulphate plus superphosphate was increased. High levels of N and P were associated with the least severe attacks, K having the opposite effect.

122. PRASAD, N., I. M. PATEL and H. M. SHAH. "Chitri" disease of tobacco in Gujarat. I. Nature of disease. Proc. 1st Conf. Tob. Res. Wkrs., Bangalore: 72-74. 1957. (Coresta 1: 79. 1958.)

In the field the disease either attacks stray plants or forms round patches. Affected plants start wilting gradually and ultimately die; their vascular and parenchymatous tissues are affected. Nematodes and two fungi, Rhizoctonia and Fusarium, were found in the field. Twelve pathogenic strains of Fusarium were isolated from affected plants; nine of these were mostly in vascular tissues and three in the parenchyma. Isolates were divided into two species: F. oxysporum var. nicotianae and F. solani var. nicotianae. The authors conclude that the disease was not caused by nematodes or Rhizoctonia although the presence of nematodes increased the incidence of disease. The disease was attributed to a complex of Fusarium strains of two categories affecting the vascular and parenchymatous tissues

respectively.

123. RABINOVICH, Z. D. (Saprophytic and pathogenic fungal microflora of jute in the southern Ukraine.) Mikrobiologiya 25: 217-220. 1956. (Biol. Abstr. 32: 3224. 1958.)
Rhizoctonia solani and Fusarium were found to cause a root rot of jute sprouts in the Odessa district of the South Ukraine Canal. Alternaria tenuis causes yellowing of the cotyledons and death of the sprouts. Trichothecium roseum decreases the germinating ability of the seeds, causing smothering and rotting of the sprouts.

124. RAGIMOV, U. A. (New diseases of cucurbits in the western districts of Azerbaijan SSR.) Proc. Acad. Sci. Azerb. SSR. 14: 65-70. 1958. (Rev. Appl. Mycol. 37: 623. 1958.)
During 1954-56 cucurbit diseases were studied in seven districts of Azerbaijan. Fusarium wilt was widespread on melons, cucumbers, and watermelons. Pythium aphanidermatum was recorded in cucumbers, melons, squash, and pumpkins. It was shown that cucurbits planted in fields previously sown with lucerne were attacked much less by Fusarium sp., to which all melons are susceptible.

125. SARMAH, K. C. Diseases in relation to environment. Two & a Bud (News Lett. Tocklai exp. Sta.) 4 (4): 14-16. 1957. (Rev. Appl. Mycol. 37: 677. 1958.)
Among tea diseases mentioned are the following: Violet root rot (Sphaerostilbe repens) is favoured by warm, wet conditions. Black root rot (Rosellinia arcuata) is found more often at high altitudes. Brown root rot (Fomes lamaoensis) occurs more usually in the plains, where its distribution differs somewhat from that of tarry root rot (Hypoxylon asarcodes).

126. SINGH, B. and R. S. SINGH. Temperature and moisture relations of the fungi causing seedling-rot, root-rot and wilt of Cyamopsis psoralioides DC. 1. Effect of temperature on growth of fungi in artificial media. 2. Effect of soil moisture on mortality under controlled conditions. Agra Univ. J. Res. (Sci.) 5: 135-141. 1956. (Rev. Appl. Mycol. 37: 103. 1958.)
Further studies at the Government Agricultural College, Kanpur, India, established that Rhizoctonia (Corticium) solani causing root rot, and Fusarium caeruleum wilt of Cyamopsis psoralioides grew best in artificial media at 28-30° and 26-28°C, respectively. Pre- and post-emergence losses due to Corticium solani occurred at 15-60 percent soil moisture. A combination of the two fungi was almost equally severe throughout the range of 15-60 percent. At 20 percent C. solani produced local necrosis of the hypocotyl and roots; at higher levels it caused rotting of the root or whole seedling.

127. STALDER, L. and F. SCHÜTZ. Untersuchungen über die kausalen Zusammenhänge des Erikawurzelsterbens. (Studies on the causal associations of root drying in Erica.) Phytopath. Z. 30: 117-148. 1957. (Rev. Appl. Mycol. 37: 239. 1958.)
The widespread and high mortality of Erica gracilis in Swiss nurseries is attributed in the first place to a disequilibrium in the root/shoot relation caused by N fertilizers, which at the same time inhibit the growth of beneficial mycorrhiza and promote that of Olpidium brassicae and an increasingly prevalent Rhizophidium sp. This is believed to be the first record of a Rhizophidium sp. as a parasite on plant roots.

128. TACONIS, P. J. (Diseases and pests of Christmas spruces.) Ned. BosbTijdschr. 29: 289-292. 1957. (Rev. Appl. Mycol. 37: 745. 1958.)
The pre-emergence phase of damping-off is associated in The Netherlands with infection by soil fungi, e.g. Corticium, Fusarium, Pythium and Coniothyrium spp., but the late stage of collapse, developing in September, has lately been shown to be due to nematodes.

129. TERMOHLEN, G. P. (Corky root of tomato caused by a sterile mycelium. II.) Tijdschr. Plantenziekten 63: 369-374. 1957. (Biol. Abstr. 32: 2083. 1958.)

Seventy percent of the isolates grown from diseased roots consisted of a sterile fungus. Inoculation experiments were successful in reproducing the disease only with sterile type fungi. Within the sterile group, about ten strains could be distinguished, differing in growth rate and color. The fungus is non-sporulating, dark-colored and slow growing. Microsclerotia were found in several cultures after 2-3 weeks.

130. TODOROVA, MME. V. (Foot and root rot of cereals.) Bull. Plant Prot., Sofia, 6: 15-28. 1957. (Rev. Appl. Mycol. 37: 527. 1958.)

Injuries resembling root rot caused by Ophiobolus graminis were observed. Gibellina cerealis was shown to cause foot rot; root rot of young plants was also attributed to Helminthosporium sativum, Rhizoctonia (Corticium) solani, Fusarium culmorum, F. nivale, and Pythium spp.

131. WAGNER, F. (Contribution to the lucerne wilt problem on the basis of a mycological study of the roots.) Pflanzenschutz 9: 109-110. 1957. (Rev. Appl. Mycol. 37: 101. 1958.)

Of 731 lucerne root fragments cultured on nutrient agar 6.95 percent yielded Verticillium albo-atrum, 3.69 percent Ascochyta imperfecta, 1.64 percent Cylindrocarpon spp., 27.31 percent Fusarium spp., 2.73 percent sterile or unidentified fungi, and 32.55 percent bacteria. Bacterial activity was great and suppressed the growth of fungi, especially V. albo-atrum and A. imperfecta, in the cultures and in some cases prevented the development of Fusarium spp., of which at least eight were probably partially responsible for the wilt. The composition of the fungal population did not remain constant during the investigation. The macroscopically visible discolorations of the vascular bundles and the cambium in wilted lucerne plants was not an infallible indication of the presence of a pathogen, while V. albo-atrum and A. imperfecta were frequently isolated from externally sound material.

132. WHITNEY, N. J. and C. G. MORTIMORE. Root and stalk rot of field corn in southwestern Ontario. I. Sequence of infection and incidence of the disease in relation to maturation of inbred lines. Can. J. Plant Sci. 37: 342-346. 1957.

Investigation of root and stalk rot showed that the stalk rot phase of the disease occurred only after the root system was nearly totally diseased. It is indicated in a footnote that Fusarium spp. and one species of Pythium were isolated consistently from the rotted roots.

133. ANNUAL REPORT OF THE JUTE AGRICULTURAL RESEARCH INSTITUTE (1955-56). 144 pp. ?1957. (Rev. Appl. Mycol. 37: 85-86. 1958.)

Fusarium solani was non-pathogenic when inoculated singly, but produced typical wilt symptoms when used together with Macrophomina phaseoli and Ozonium sp. Root rot of Hibiscus cannabinus was associated with Macrophomina phaseoli and F. oxysporum, alone or in combination, causing more damage together.

134. NEW VEGETABLE VARIETIES, LIST V. Proc. Amer. Soc. hort. Sci., 71: 591-600. 1958. (Rev. Appl. Mycol. 37: 746. 1958.)

Among vegetable varieties listed, with their resistance to various diseases (in parentheses), are (1) celery Slow Bolting Green No. 12 (yellows -- Fusarium apii); (2) peas Glacier, Surpass, Hardy, and others (Fusarium wilt -- F. oxysporum f. pisi), and Pacific Freezer (Fusarium root rot -- Fusarium spp.); (3) sweet potato Coppergold (stem rot -- F. bulbigenum var. batatis); (4) the tomatoes J. Moran, Grathens Globe (W. R.), and others (Fusarium wilt -- F. bulbigenum var. lycopersici), Grand Pak (resistant to Verticillium albo-atrum). The potato variety Merrimack is highly resistant to late blight (Phytophthora infestans) and ring rot Corynebacterium sepedonicum).

135. TWENTY-FIRST BIENNIAL REPORT, STATE PLANT BOARD OF FLORIDA, 1954-56. Rep. Fla. Pl. Bd. 2 (Bull. 11A). 1957.

The ornamental pathology section (pp. 78-89) of this report states that the most serious disease of pompon chrysanthemum is root rot and wilt, a complex of Pythium spp., Rhizoctonia (Corticium) solani, Fusarium oxysporum, and nematode damage.

Fungi -- Aphanomyces

136. SCHNEIDER, C. L. Further studies on the host range of Aphanomyces cochlioides. (Abstr.) Phytopathology 48: 463-464. 1958.

Seedlings of 94 plant species representing 31 families were exposed to zoospores of A. cochlioides in Petri dishes and in pots of soil. The species that became infected are named. In addition, the fungus was isolated from plants of each of these species grown in naturally infested field soil. A list of older plants as well as seedlings of common weeds and cultivated plants that were susceptible to infection is also given.

Fungi -- Armillaria

137. GIBSON, I. A. S. Armillaria root rot. Rep. For. Dep. Kenya, 1954-55, p. 20. 1957. (Rev. Appl. Mycol. 37: 190-191. 1958.)

In a survey for A. mellea in Kenya pine plantations Pinus canariensis was found to be the most susceptible and P. halepensis the least, with P. patula and P. radiata intermediate; plantations on grassland sites had little infection, while sites carrying bamboo, indigenous forest, or previous plantations were infested to a certain extent.

138. RAABE, R. D. Some previously unreported non-woody hosts of Armillaria mellea in California. Plant Disease Reptr. 42: 1025. 1958.

The oak root fungus, Armillaria mellea, has been found on non-woody or herbaceous plants. These include Amaryllis vittata, Fuchsia hybrida, Impatiens oliverii, Pelargonium domesticum, and P. peltatum.

Fungi -- Botryodiplodia
See also 219

139. TWEEDY, B. and D. POWELL. Charcoal rot on strawberry in Illinois. Plant Disease Reptr. 42: 107. 1958.

The charcoal rot organism, Botryodiplodia phaseoli (Maubl.) Thirumalachar, was isolated from vascular tissue of both roots and aboveground parts of strawberry. It has been established that the charcoal rot requires a high temperature along with a dry soil for best development.

Fungi -- Centrospora

140. SRIVASTAVA, S. N. S. Studies on Centrospora acerina (Hartig) Newhall, the cause of licorice rot of carrot. Trans. Brit. Mycol. Soc. 41: 223-226. 1958. (Rev. Appl. Mycol. 37: 692. 1958.)

Licorice rot of carrots was observed in Scotland in a field where they had been left overwinter. Only one of three varieties in the field was attacked. The fungus was shown to be pathogenic to celery.

Fungi -- Ceratocystis

141. BILBRUCK, JAMES DONALD. The oak wilt fungus, Ceratocystis fagacearum (Bretz) Hunt: Studies of the rate and extent of fungus penetration in oak roots and the nature of a toxic principle in oak heartwood which inhibits growth of the fungus. Diss. Abstr. 18: 372-373. 1958. (Biol. Abstr. 32: 3500. 1958.)

142. YOUNT, W. L. Results of root inoculations with the oak wilt fungus in Pennsylvania. Plant Disease Reptr. 42: 548-551. 1958.

Red oak trees in four series 1954, 1955, 1956, and 1957, were inocu-

lated with Ceratocystis fagacearum in the roots at varying distances from the trunk. Trunk-inoculated trees served as check. Incubation periods for both trunk- and root-inoculated trees varied extensively from season to season. The length of time between inoculation and the first foliage symptoms was longer for the root-inoculated trees in every series. Possible reasons for this are discussed.

Fungi -- Clitocybe

143. DADANT, R. Le pourridié du caféier à Madagascar. (Root rot of coffee in Madagascar.) Café, Cacao, Thé, 1: 126-131. 1957. (Hort. Abstr. 28: 487. 1957.)

The parasitic fungus Clitocybe tabescens can survive for 6-7 years in dead coffee or other wood. Various hosts are listed, a very common one being Albizzia lebbeck, the principal coffee shade tree of Madagascar. No effective fungicidal treatment has yet been evolved. Spread of the disease has been successfully checked by ascertaining the exact extent of every affected section of the plantation and bark-ringing every diseased tree and every healthy coffee and shade tree in a belt surrounding the diseased patch. The exposed wood is treated with mineral oil to prevent bark renewal, and after exhaustion of root carbohydrate reserves and subsequent death these trees form a barrier against the fungus.

Fungi -- Colletotrichum

144. PULSIFER, H. G. Damping-off of cotton seedlings caused by Colletotrichum hibisci Poll. Iowa State Coll. Jour. Sci. 32: 57-61. 1957. (Biol. Abstr. 32: 875. 1958.)

Isolates of C. hibisci capable of causing tip blight and other symptoms in kenaf (Hibiscus cannabinus) were also capable of causing damping-off of cotton (Gossypium) seedlings, producing symptoms typical of damping-off due to C. gossypii.

Fungi -- Corynespora

145. BOOSALIS, M. G. and R. I. HAMILTON. Root and stem rot of soybean caused by Corynespora cassiicola (Berk. & Curt.) Wei. Plant Disease Reptr. 41: 696-698. 1957.

Corynespora cassiicola was found to cause a previously undescribed root and stem disease of soybean. Soil temperatures above 19° to 21°C arrest the development of the disease before it can damage the host sufficiently to inhibit yield. The highest incidence of the disease was found in fields where soybeans had been planted for 2 successive years. The pathogen overwinters on infected root and stem tissues of soybeans and survives in infested, unsterilized soil for at least 2 years.

Fungi -- Dialonectria

146. ORIAN, G. Plant Pathology Division. Rep. Dep. Agric. Mauritius, 1955, pp. 90-93, 1957. (Rev. Appl. Mycol. 37: 205. 1958.)

Sphaerostilbe repens, as Dialonectria sp., was found associated with root disease in an experimental tea plot.

Fungi -- Fomes

147. JONES, T. W. and T. W. BRETZ. First report of tree mortality from Fomes annosus root rot in Missouri. Plant Disease Reptr. 42: 988. 1958.

Fomes annosus, root rot, has been identified as the cause of extensive mortality in a plantation of shortleaf pine (Pinus echinata) in Missouri, where it was first observed in 1956. Additional killing of trees from the same cause continued during 1957.

148. MOLIN, MILS. A study of the infection biology of Fomes annosus. Medd. Skogsforskn.

Inst. Stockholm 47: 1-36. 1957. (English summary)
Root rot, Fomes annosus, in a young pine plantation was found to be spread by infection of roots in contact with infected old spruce stumps.

149. RIGGENBACH, A. Report of Plant Pathology Department. Rep. Rubb. Res. Inst. Ceylon, 1956, pp. 40-48. 1957. (Rev. Appl. Mycol. 37: 180. 1958.)
Root diseases (of rubber trees) especially white root (Fomes lignosus) are commonly present in replanted areas.

Fungi -- Fusarium

See also 21, 41, 61, 65, 66, 67, 82, 83, 85, 330, 333, 353, 378, 492, 525, 532, 617, 655, 657, 658, 698, 714, 715, 717, 723, 726, 728, 731, 732, 745, 746

150. ARMSTRONG, G. M. and J. K. ARMSTRONG. Effect of cutting roots on the incidence of Fusarium wilt of cotton, tomatoes, cowpeas and other plants. (Abstr.) Phytopathology 48: 341. 1958.
The percentage of plants showing external symptoms of wilt and the average number of days required for the first symptoms to develop were recorded. The procedure followed is outlined.

151. ARMSTRONG, G. M. and J. K. ARMSTRONG. The Fusarium wilt complex as related to the sweetpotato. Plant Disease Reptr. 42: 1319-1329. 1958.
Ninety-two pathogenic isolates of wilt Fusaria from sweetpotato and 28 from flue-cured tobacco were tested on Porto Rico sweetpotato. Fifty-nine sweetpotato isolates were pathogenic on burley but only 23 were pathogenic on flue-cured tobacco. All tobacco isolates were pathogenic on flue-cured tobacco and sweetpotato; those tested on burley were also pathogenic on this host. The problem of reduction in pathogenicity of cultures is discussed. The host relationships of these races (1 and 2) and those from cotton, alfalfa, soybean, and cowpea are compared.

152. ARMSTRONG, J. K. and G. M. ARMSTRONG. A race of the cotton-wilt Fusarium causing wilt of Yelredo soybean and flue-cured tobacco. Plant Disease Reptr. 42: 147-151. 1958.
Fusarium isolates were obtained from wilted soybeans in S. Carolina that wilted Yelredo soybean but not cowpea. They also caused wilt of cotton and of burley and flue-cured tobacco which are not the hosts for the two races (1, 2) of the cowpea-wilt Fusarium. Field observations (1938) indicated that the cotton-wilt Fusarium (F. vasinfectum or F. oxysporum f. vasinfectum Sny. & Hansen) was probably a cause of wilt of burley tobacco. This was verified by inoculation experiments. The host complex for the new race of cotton wilt Fusarium is the subject of this report.

153. BACHY, A. and C. FEHLING. (Vascular wilt of oil palm in the Ivory Coast.) J. Agric. trop. Bot. appl., 1957, 4: 228-240. 1957. (Hort. Abstr. 28: 303. 1958.)
The conditions favouring the occurrence of vascular wilt (Fusarium oxysporum f. elaeidis) in palms in the Ivory Coast were studied. Infection was found on both adult and replanted palms. Wilt spread was twice as fast on plots low in K as on plots with high K levels. It also occurred where Mn was deficient. Wilt infection seemed to be more frequent in low-lying areas.

154. CHATTERJEE, PARUL. The bean root rot complex in Idaho. Phytopathology 48: 197-200. 1958. (Biol. Abstr. 32: 2952. 1958.)
Evidence is presented to indicate that dry root rot of beans in Idaho is caused primarily by Fusarium solani f. phaseoli (Burkh.) Snyd. & Hans. There appeared to be three distinct physiologic and pathogenic strains of this species among the 224 isolates studied. Histological examination of infected plants revealed that F. solani f. phaseoli is capable of entering plants by direct penetration through stomata on the hypocotyl and through wounds. The mycelium of the most virulent isolates spread quickly through-

out the cortical tissue of the host plants but less virulent isolates appeared to be restricted in their development by the deposition of a brownish colored substance in the cortical cells adjacent to the points of entry.

155. CHATTOPADHYAY, S. B. and S. K. SEN GUPTA. Wilt of egg-plant (Solanum melongena L.). Indian J. mycol. Res. 2: 83-86. 1956. (Rev. Appl. Mycol. 37: 754. 1958.)

A wilt of eggplant in West Bengal was found to be caused by Fusarium solani. Pathogenicity was proved on Sutton's Long Purple.

156. COE, D. M. Some recent developments in diseases of ornamental plants in Florida. Proc. Fla. hort. Soc., 70 (1957): 390. 1958. (Rev. Appl. Mycol. 37: 664. 1958.)

Wilt (Fusarium (oxysporum f.) perniciosum) of Albizzia julibrissin is well established over a large area in northern Florida, where it is causing serious losses.

157. COLLINS, R. P. and R. P. SCHEFFER. Respiratory responses and systemic effects in Fusarium-infected tomato plants. Phytopathology 48: 349-355. 1958. (Chem. Abstr. 52: 21. 1958.)

Respiration in leaves of tomato plants was stimulated soon after infection with Fusarium oxysporum f. lycopersici and reached a peak 9-14 days after inoculation. Stems responded similarly. Evidence of systemic toxemia was found. Ethylene, fusarinic acid, and probably pectic enzymes were eliminated as respiratory stimulants. Ethylene hastened disease development when introduced in solution into inoculated susceptible cuttings and caused cuttings of similarly treated resistant plants to become diseased.

158. COULOMBE, L. J. (Fusarium wilt of broad beans.) Rep. Quebec Soc. Prot. Pl., 38 (1956): 26-33. 1957. (English summary) (Rev. Appl. Mycol. 37: 434. 1958.)

Wilt of broad beans caused by Fusarium oxysporum f. fabae appears to be becoming progressively more prevalent in Quebec. Isolates from affected plants were highly virulent when inoculated in sandy and compost soils.

159. DeVAY, J. E. et al. Corn diseases and their importance in Minnesota in 1956. Plant Disease Reptr. 41: 505-507. 1957. (Biol. Abstr. 32: 2953. 1958.)

In Minnesota large amounts of fertilizers are used occasionally with no regard to the balance of available mineral elements in a particular soil. As a result of these practices, a marked increase in the damage caused by various diseases and pests of corn has been apparent. Gibberella spp. and Fusarium spp. are the most important causes of stalk rot in living plants in all stages of post-emergence in Minnesota.

160. DESROSIERS, R. and E. AMPUERO. Las enfermedades más importantes del campo que afectan al banano en el Ecuador. (The most important diseases affecting bananas in the field in Ecuador.) A.N.B.E. (Asoc. nac. Banan. Ecuador) 2 (1): 33-36. 1957. (Rev. Appl. Mycol. 37: 362. 1958.)

The symptoms and control of Panama disease (Fusarium oxysporum f. cubense) and bacterial wilt (Xanthomonas (Pseudomonas) solanacearum) in Ecuador are described.

161. ERWIN, DONALD C. Fusarium lateritium f. ciceri, incitant of Fusarium wilt of Cicer arietinum. Phytopathology 48: 498-501. 1958.

A new name, Fusarium lateritium Nees emend. Snyd. & Hans. f. ciceri (Padwick) n.f., is proposed for the incitant of Fusarium wilt of Cicer arietinum L. (garbanzo bean). Symptoms included a gray-green fading of leaves and a dark brown discoloration of the xylem tissues of the stems.

162. EVERETTE, G. A. Strains of Fusaria and their effect on tobacco varieties. Tobacco 146: 20-5. (Tobacco Sci. 2: 35-40) 1958. Tobacco Abstr. 2: 221. 1958.

A laboratory method of indexing varieties for resistance to Fusarium

wilt has not been refined to a point where it is reliable for individual plant selection. Classification of the isolates into groups was made by using cotton, sweetpotatoes, and flue-cured, dark-fired, one-sucker, and burley tobaccos. At least 17 strains of Fusarium, differing in pathogenicity, seem to be represented in the collection of isolates at the Kentucky Agricultural Experiment Station.

163. FORSBERG, JUNIUS L. Fusarium disease of gladiolus; its causal agent. Illinois Nat. Hist. Surv. Bull. 26: 447-503. 1955. (Biol. Abstr. 32: 262. 1958.)

After making a study of pathogenicity and physiology of 40 isolates of Fusarium from diseased corms, Forsberg proposed that all forms of the gladiolus Fusarium be included under the name F. oxysporum f. gladioli as causal agents of vascular, brown rot, and basal dry rot of gladiolus.

164. GERLACH, W., W. SAUTHOFF and H. PAG. Untersuchungen über die Fusarium-Welke an Aechmea fasciata (Lindl.) Bak. (Erreger: Fusarium bulbigenum Cke. et Mass. f. aechmeae Gerlach et Sauthoff n. f.). (Studies on the Fusarium wilt of A. fasciata (Lindl.) Bak. (Causal agent: F. bulbigenum Cke & Mass. f. aechmeae Gerlach & Sauthoff n. f.).) Phytopath. Z., 32: 416-432. 1958. (English summary) (Rev. Appl. Mycol. 38: 6-7. 1959.)

Tracheomycosis was associated with a wilt disease of Aechmea fasciata in Germany. The sole pathogen was a Fusarium of the section Elegans. The morphological characters are described. The name F. bulbigenum Cke. et Mass. f. aechmeae Gerlach et Sauthoff was proposed. The pathogenicity of this Fusarium was demonstrated.

165. GRAY, E. G. and I. A. NICHOLSON. Snow mould on upland pasture in North Scotland. Trans. & Proc. Bot. Soc. Edinburgh 32: 123-128. 1957. (Biol. Abstr. 22: 2082. 1958.)

Snow mould (Fusarium nivale) was prevalent in upland pasture in North Scotland in 1954-1956. Agrostis spp., A. canina, A. stolonifera, A. tenuis, Lolium perenne, Poa annua, and P. trivialis were most severely affected. Heavy autumn rainfall and prolonged snow cover in early spring apparently favored infection. In areas where grass had been killed out by snow mould, Aira praecox and certain mosses grew well and became dominant.

166. HAGEDORN, D. J. Some observations on diseases of Pisum sativum in several European countries in 1957. Tijdschr. PlZiekt. 64: 263-268. 1958. (Dutch summary.) (Rev. Appl. Mycol. 37: 748. 1958.)

In the Netherlands top yellows (pea leaf roll virus) was the most important disease and was often associated with foot or root rot (Fusarium spp.). Wilt (F. oxysporum f. pisi) was seen in two fields in England. In West Germany, where streak was the most important disease seen, Fusarium root rot (F. solani var. (f.) pisi) was also found, with other diseases.

167. HARRISON, D. J. A Fusarium rot of bulbous iris. Plant Pathology 7: 16-18. 1958.

Results indicate that a strain of Fusarium oxysporum causes a rot of bulbous iris. The fungus does not spread, at least to any extent, from diseased to healthy bulbs in the soil under greenhouse conditions. High temperatures appeared to favor incubation. It was observed that species of Penicillium frequently developed on the bulbs following a Fusarium rot. This often made it difficult to re-isolate Fusarium oxysporum following secondary invasion.

168. HENDRIX, FLOYD F. Jr., and L. W. NIELSEN. Invasion and infection of crops other than the forma suscept by Fusarium oxysporum f. batatas and other formae. Phytopathology 48: 224-228. 1958. (Biol. Abstr. 32: 2953. 1958.)

In greenhouse and field experiments, the ability of various wilt-inciting Fusaria to invade and colonize roots of crops other than the formae suscepts was studied, with emphasis on F. oxysporum f. batatas. F. oxysporum f.

batatas invaded and colonized the roots and stems of tomato, sweetpotato, cabbage, tobacco, soybean, snapbean, Irish potato, watermelon, cowpea, corn, and cotton when grown in sand culture. In other sand culture tests sweetpotato roots were invaded and colonized by F. oxysporum formae niveum, phaseoli, vasinfectum, lycopersici, conglutinans, and nicotianae. Only f. nicotianae caused external wilt symptoms in sweetpotato. Cultures of F. oxysporum f. lycopersici isolated from sweetpotato roots were less pathogenic to tomato than was the original culture. The several crops were planted in two fields naturally infested with F. oxysporum f. batatas. Two and 6 weeks after planting replicated samples of plants from each crop were collected for appraising their invasion by Fusaria. Fusaria were isolated from roots and stems of tomato, sweetpotato, cabbage, tobacco, soybean, snapbean, watermelon, cowpea, corn, and cotton. Wilt symptoms developed only in sweetpotato plants. Isolates from tobacco, soybean and corn were more pathogenic to sweetpotato than isolates from cowpea, snapbean, or tomato, but less pathogenic than isolates from sweetpotato plants. However, some isolates from tobacco, soybean and corn were as pathogenic as the isolates from sweetpotato. The ability of F. oxysporum f. batatas and other formae to invade and colonize the roots and stems of plants other than the formae suscepts provides another means by which wilt Fusaria persist in soils in addition to their pathogenic and saprophytic habits.

169. HILDEBRAND, E. M. et al. Studies on sweet potato stem rot or wilt and its causal agent. Plant Disease Reptr. 42: 112-121. 1958.

This investigation sheds light on the cultural identity and pathogenic behavior of the sweetpotato Fusarium (F. oxysporum Schlecht. f. batatatis (Wr.) Snyder & Hansen), the causal agent of stem rot or wilt disease.

170. HOUSTON, BYRON R., P. F. KNOWLES, and L. J. ASHWORTH. The determination of pathogenic races of Fusarium oxysporum f. lini. (Abstr.) Phytopathology 48: 394. 1958.

Sixty isolates of Fusarium oxysporum f. lini were tested to determine the variability of pathogenicity on six pure lines of flax derived from single plant selections of four varieties. Five distinct pathogenic races of the fungus were determined by differential pathogenicity on the six hosts.

171. HWANG, L., Y-S. CHEN and H-Y. HWANG. A preliminary study of sweet potato wilt and its control. Acta phytopath. sinica 2: 97-113. 1956. (Rev. Appl. Mycol. 37: 179-180. 1958.)

Sweetpotato wilt attacks the fibro-vascular bundles and infects cuttings and plant parts in close contact with the soil. The infected parts have a water-soaked appearance and later blacken and rot. Fusarium spp. were found associated with the disease. High humidity and high temperature are closely related to disease development.

172. JAMALAINEN, E. A. Overwintering of plants in Finland with respect to damage caused by low-temperature pathogens. Publ. Finnish State Agric. Res. Bd. 148: 5-30. 1956. (Biol. Abstr. 32: 1481. 1958.)

One of the most important reasons for poor overwintering is the presence of pathogenic fungi. In winter rye, winter wheat and other gramineous plants, damage is caused by Fusarium nivale and other fungi. Red clover was attacked by Fusarium in northern Finland.

173. KLING, E. G. (On the physiology of gladioli with yellows disease.) Bull. centr. bot. Gdn, Moscow, 1958, 30: 72-77. 1958. (Rev. Appl. Mycol. 37: 665. 1958.

In several regions in the U.S.S.R. infection by Fusarium sp. and yellows has become very severe since 1954. Author recommends a 3- to 4-year interval before planting corms in fields that have had diseased plants, destruction of diseased plants early in the season, disinfection of the corms after harvesting and before planting, and the use of resistant

varieties only.

174. LAKSHMINARAYANAN, K. The physiology of host-parasite relationship in the Fusarium wilt of cotton. II. Pectin methyl esterase formation by Fusarium vasinfectum Atk. III. Distribution and derangement of free amino acids. Proc. Indian Acad. Sci., Sect. B, 47: 78-86, 115-123. 1958. (Rev. Appl. Mycol. 37: 479. 1958.)

The distribution of 23 amino acids in the roots, shoots, and leaves was examined chromatographically in 6- and 12-day-old susceptible and resistant varieties of cotton infected by F. vasinfectum and in healthy controls. In the control series cystine was consistently present in all organs of the resistant varieties but completely absent from susceptible variety K2, suggesting a relationship with the mechanism of wilt resistance. In the inoculated series cystine made its appearance in susceptible (K2) plants (roots and shoots only) at 6 days but was absent from these and from resistant varieties at 12 days. It is suggested that the appearance of cystine in K2 may represent a systemic immunological response.

175. MARLATT, ROBERT B. Onion Fusarium basal rot in Arizona. Plant Disease Reptr. 42: 667-668. 1958.

A greenhouse experiment showed that onion bulbs were readily infected by the fungus, F. oxysporum f. cepae, when roots had been injured mechanically. Apparently healthy bulbs grown in inoculated soil could develop Fusarium basal rot when stored for 3 months at 75° F to 85° F.

176. MARTIN, J. P. and J. O. ERWIN. Changes in fungus populations of California orchard soils when cropped to orange seedlings in the greenhouse. Soil Sci. 86: 141-147. 1958.

It was found that the total numbers of fungi increased during cropping in the greenhouse while the kinds decreased. Fusarium solani persisted in similar numbers in the greenhouse and field soils.

177. NEELY, R. D. A study of Fusarium root rot and wilt of soybeans. Diss. Abstr. 17: 2132. 1957. (Rev. Appl. Mycol. 37: 568. 1958.)

In summer, 1953, a new disease of soybeans caused by F. orthoceras was reported from north-central Missouri on heavy river bottom soils. Symptoms were slight chlorosis, rapid wilting and subsequent drying of the leaves which remain attached to the stem, necrosis of lateral roots and discoloration of the vascular system of root and stem. Certain strains were tolerant or genetically resistant. The fungus tolerated a wide pH range (2-11) and temperatures of 10° to 40° C. A flooding inoculation technique was used. Variation in pathogenicity within F. orthoceras was noted. Wilt production is ascribed to a non-volatile substance, toxic to soybean plants, which is produced by the fungus on Richard's solution, later replaced by distilled water for 48 hours.

178. NISHIMURA, S. Observations on the fusaric acid production of the genus Fusarium. Ann. phytopath. Soc. Japan, 22: 274-275. 1957. (Japanese. Abs. from English summary.) (Rev. Appl. Mycol. 37: 763. 1958.)

It is reported that in a study of 25 strains of six species of Fusarium all strains belonging to F. oxysporum and F. moniliforme (Gibberella fujikuroi) produced fusaric acid in culture whereas those of other species (F. solani, F. lateritium (G. lateritia), F. roseum, and F. nivale (Calonectria nivalis)) did not.

179. NISHIMURA, S. Pathochemical studies on watermelon wilt. (Part 5.) On the metabolic products of Fusarium oxysporum f. niveum (E. F. Smith) Snyder et Hansen. Ann. phytopath. Soc. Japan 22: 215-219. 1957. (Japanese. Abs. from English summary.) (Rev. Appl. Mycol. 37: 753. 1958.)

These further studies on Fusarium (bulbigenum var.) niveum include a chromatographic method indicating the amount of fusaric acid present, one of the metabolic products of the pathogen responsible for the develop-

ment of the disease symptoms. It was detected in soils infested by the pathogen.

180. OSTAZESKI, S. A. The initial symptoms of red clover root rot; associated fungi, and the effect of inoculation methods on their pathogenicity. Diss. Abstr. 17: 2396-2397. 1957. (Rev. Appl. Mycol. 37: 547. 1958.)

In the early stages of red clover root rot greenhouse-grown plants were invaded by nematodes and a mycorrhizal fungus 10 days after planting. After 18 days lesions were found in the roots and after 45 days spots and killed rootlets were found. Most plants had no rootlets on the upper part of the taproot after 72 days. Fungi were associated with crown rots, outer phloem decay, in the cortex and epidermis of noncambial roots, but not with brown deposits in the xylem adjoining the remains of a dead or dying lateral root. The most frequent isolates included F. oxysporum and F. solani; other Fusarium spp. were among less frequently found fungi. When soil was inoculated with whole oats or maize-meal sand on which F. solani, F. oxysporum, or Gliocladium roseum had been cultured, all three were pathogenic. When mixed with soil as spore suspensions, blended tube cultures, or soil substrate inoculum, they were usually non-pathogenic. Other pathogenicity tests were conducted.

181. PARKINSON, D. and C. G. C. CHESTERS. Occurence of Fusarium culmorum (W. G. Sm.) Sacc. in the rhizosphere of oats. Nature 181: 1746-1747. 1958. (Rev. Appl. Mycol. 37: 532-533. 1958.)

At the University of Nottingham studies on the fungal components of the rhizosphere microflora of oats revealed striking changes in the fungi present with increasing age of the roots and at different positions in the rhizosphere. F. culmorum and other Fusarium isolates (including F. avenaceum) increased in frequency with increasing age of the plants, most rapidly in the crown zone and least at the tip. Increase in the amount of F. culmorum present in root material was recently demonstrated to be associated with the degree of decomposition of the root. It would appear, therefore, that under an oat crop approaching senescence there develops in the soil a population of a potential pathogen which could have serious effects on a subsequent cereal crop.

182. PRENDERGAST, A. G. Observations on the epidemiology of vascular wilt disease of the oil palm (Elaeis guineensis, Jacq.). J. W. Afr. Inst. Oil Palm Res., 2: 148-175. 1957. (Rev. Appl. Mycol. 37: 52. 1958.)

Vascular wilt was significantly less in areas which had received adequate applications of K. New infections tended to be more frequent adjacent to existing ones, and severe wilt occurred in young palms replanted in old wilt sites.

183. PŘÍHODA, A. (Cactus rot.) Živa 4: 141-143. 1956. (Rev. Appl. Mycol. 37: 356. 1958.)

The symptoms and development of fungal disease of cacti caused by F. oxysporum, F. aqueductum var. dimerum, and other fungi are described.

184. PROTSENKO, E. P. (Premature yellowing of gladioli.) Bull. centr. bot. Gdn, Moscow, 1958, 30: 78-84. 1958. (Rev. Appl. Mycol. 37: 665. 1958.)

In many districts in the U.S.S.R. yellowing of gladioli caused by Fusarium spp. reaches 60 to 80 percent. The predominant species appear to be F. orthoceras var. gladioli causing withering, and F. oxysporum var. gladioli, rotting the corms. The pathogenicity of the two species was established by inoculation and dipping the roots in a spore suspension. Withering and yellowing is a specific tracheomycosis following the rotting of the rootlets by nonspecific Fusarium infection.

185. RAHEJA, P. C. and G. P. DAS. Development studies in crop plants II. -- Effect of cultural treatment on the incidence of gram wilt. Indian J. agric. Sci., 27: 237-

250. 1957. (Rev. Appl. Mycol. 37: 626-627. 1958.)

Work at New Delhi on the effect of spacing and date and depth of sowing on the occurrence of gram (Cicer arietinum) wilt (Fusarium orthoceras var. ciceri) showed the treatments to have no effect on early wilt which occurred 10-15 days after sowing. Incidence of late wilt decreased with delayed sowing, shallow seeding and wider spacing.

186. REID, JAMES. Studies on the Fusaria which cause wilt in melons. I. The occurrence and distribution of races of the muskmelon and watermelon Fusaria and a histological study of the colonization of muskmelon plants susceptible or resistant to Fusarium wilt. Can. J. Botany 36: 393-410. 1958.

It has been shown that more than one type of isolate of both the muskmelon Fusarium and the watermelon Fusarium occur naturally in infested soil. The isolates of both organisms could be divided into many cultural races, depending on the number of isolations made. Among these cultural races differences were demonstrated in their ability to establish successful host-parasite relationships with their respective host plants. The field reactions of various host varieties were shown to be a function of the races present in a soil at a given time. Fluctuations in the relative frequency of the race present in a field have been shown to occur, as well as changes in the races present. The effect of temperature on colonization appeared to be on the aggressiveness of the parasite rather than on the susceptibility of the host.

187. REID, JAMES. Studies on the Fusaria which cause wilt in melons. II. The effect of light, nutrition, and various chemicals on the sporulation of certain fusarial isolates, and preliminary investigations on the etiology of wilting of the muskmelon Fusarium. Can. J. Botany 36: 507-537. 1958.

Light was shown to affect the amount of microspore production in a number of Fusarium species. Macrospore production and the ratio of macrospores to microspores increased with increasing light intensity and vice versa. Only colony areas exposed to light during active growth produced macrospores on PDA or Czapek's agar. Both C- and N-sources were important in determining the kind and amount of sporulation in the species tested. Colony growth was appressed in light and pigmentation of the mycelium was produced in response to light. Various enzyme inhibitors induced different effects on growth and sporulation. Studies on the etiology of wilting indicated that the muskmelon Fusarium produces at least three chemical fractions which may contribute to wilting.

188. SAUTHOFF, W. and W. GERLACH. (On a hitherto unknown Fusarium wilt disease of Aechmea fasciata (Lindl.) Bak.). NachrBl. dtsch. PflSchDienst (Braunschweig), Stuttgart, 10, 1, 1-3. 1958. (Rev. Appl. Mycol. 37: 356. 1958.)

F. bulbigenum f. aechmeae f. nov. causes a wilt of Aechmea fasciata (ornamental) in Berlin. A wilt of the seedling leaves is followed by the appearance on the leaf base of a grey-green or brownish lesion, which under warm humid conditions rapidly spreads upwards over the leaf surface. The leaf collapses when the free part of the blade is reached and later rolls up and dries. This condition spreads from the outer to the inner leaves. Under cool dry condtions the original leaf base lesion does not spread upwards, but the fungus slowly penetrates the bases of the inner leaves. The internal symptoms are little affected by the environment. Brown discoloration of the vessels in the stem close behind the growing point is a reliable diagnostic feature. It is thought that Fusarium normally enters by the roots.

189. SCHNEIDER, R. (Studies on the variability and taxonomy of Fusarium avenaceum (Fr.) Sacc.). Phytopath. Z. 32: 95-126, 129-148. 1958. (Rev. Appl. Mycol. 37: 763. 1958.)

Sixty-eight single-spore isolates of F. avenaceum of different origin were examined in pure culture. The single-spore progeny of the initial cultures of all strains developed 70 to 100 percent variations. In paper No.

2 it is demonstrated that the morphological deviations of three variants from the original form of the fungus are linked with a loss of virulence and pathogenicity. They differed in pathogenicity not only from the original but also among themselves. In infection tests it was impossible to recreate the original virulence and pathogenicity by single or repeated passage through the host. The re-isolations were identical with the original inoculum. The forms from cereals, Lupinus spp., and carnation were not only pathogenic to their own hosts and to closely related species, and species of other genera in the same family, but also gave positive results in cross-infection tests. Thus, F. avenaceum is not host specific.

190. SEQUEIRA, L. et al. Role of root injury in Panama disease infections. Nature 182: 309-311. 1958. (Hort. Abstr. 28: 645. 1958.)

A heavy spore suspension of F. oxysporum f. cubense was applied to healthy main root surfaces both at the tip and in mature regions. No penetration was observed and the pathogen showed no evidence of ability to attack living cells of the main root. When the mature tissue of the main root was wounded deeply enough to expose the xylem, fungus penetration occurred rapidly. Wounding of immature tissue of the main root, however, did not result in fungus penetration. Some penetration of apparently intact lateral rootlets occurred, but injury was an important factor in rootlet invasion. There was a consistent stimulation of spore germination in the vicinity of a wounded root surface and an inhibition of spore germination by the intact root surfaces.

191. STOVER, R. H. and S. R. FREIBERG. Effect of carbon dioxide on multiplication of Fusarium in soil. Nature 181: 788-789. 1958.

F. oxysporum (lycopersici, nicotianae, cucumerinum) was stimulated by air enriched with 4 percent $CO_2$; other Fusaria gave erratic results (including F. solani and F. roseum). It was then determined that F. oxysporum f. cubense was able to fix (radioactive) carbon ($CO_2$) in its mycelium. This led the authors to suggest that stimulation of multiplication of the Fusarium species studied may be due to participation of $CO_2$ from the soil atmosphere in metabolic processes of the fungus.

192. STOVER, R. H. Studies of Fusarium wilt of bananas. II. Some factors influencing survival and saprophytic multiplication of F. oxysporum f. cubense in soil. Can. J. Botany 36: 311-324. 1958.

The effect of 1 percent glutamic acid, banana sap, water, and $CO_2$ on sporulation of F. oxysporum f. cubense in infested soil was studied under laboratory conditions. Increases in population were determined by microscopic examination and dilution plating on PDA containing rose bengal and streptomycin. The amount of multiplication (fungus) varied among different soils, samples from the same soil, and different experiments. This is attributed to unknown variables influencing multiplication and survival in soil microhabitats. The evidence obtained supports the thesis that F. oxysporum f. cubense can multiply saprophytically in soil.

193. TAMMEN, JAMES. Pathogenicity of Fusarium roseum to carnation and to wheat. Phytopathology 48: 423-426. 1958.

Sixty-two clones of Fusarium roseum were studied in a series of five cross-pathogenicity tests to determine whether the clones that incite a root, crown, and stem rot disease of the perpetual flowering carnation were pathogenically distinct from those of F. roseum f. cerealis which incites a seedling blight and root or foot rot of cereals. It is concluded that pathogenic clones of F. roseum, irrespective of the original host from which they were isolated, are not pathogenically specialized in respect to the tested host plants and that the carnation pathogen is F. roseum f. cerealis.

194. TEAKLE, D. S. Fusarium foot rot of cucurbits. Queensland Agric. Jour. 83: 253-255. 1957. (Biol. Abstr. 32: 1177. 1958.)

Foot rot in Queensland is caused by Fusarium solani f. cucurbitae which produces an orange colored rot on stems near the ground. Susceptibility of cucurbits ranges from high in pumpkins to low in cucumbers and rock melons. The disease becomes established in the soil and rotations of at least 3 years are necessary in infested areas. The fungus is also seed-borne, entering cucurbit fruit from the soil and penetrating the seed.

195. VAN ANDEL, O. M. Importance of amino-acids for the development of Fusarium oxysporum f. lupini Sn. et H. in xylem of lupins. Acta bot. neerl., 1956, 5: 280-286; Lab. Phytopath. Wageningen, 1956, Meded. 166. (J. Sci. Food Agr. 9: i-195. 1958.)

The growth of the fungus in a medium containing, as the sole source of C, one or more of the amino acids associated with the xylem-sap is studied. It is very unlikely that these amino acids act as sources of C for the invading fungus. No evidence is found of any inhibitory substance in the sap.

196. WEBER, G. F. Vascular wilt of mimosa in Florida. Plant Disease Reptr. 41: 640-642. 1957. (Biol. Abstr. 32: 2955. 1958.)

The wilt disease of mimosa, due to Fusarium oxysporum f. perniciosum, has been spreading in Florida since 1952. Extensive bleeding on the trunk in the early stages of the disease was observed.

197. WOLF, F. T. Nutrition and metabolism of the tobacco wilt Fusarium. Torrey Bot. Club. B 82: 343-354. 1955. (Tobacco Abstr. 2: 397. 1958.)

The tobacco wilt fungus, F. oxysporum var. nicotianae, is able to utilize a wide variety of carbon sources. Only D-arabinose, lactose, and melibiose were poorly utilized of 16 substances tested. The fungus utilized nitrate, ammonium, or amino nitrogen. Growth on certain amino acids is far superior to that obtained on inorganic nitrogen sources. Nucleic acid derivatives were less effective than the best of the amino acids as sources of nitrogen. In shake culture the pathogen grows in a yeast-like fashion. In culture filtrates a red water-soluble pigment is produced which has the properties of an indicator. This pigment has been identified as rubrofusarin.

198. YAMAMOTO, W., N. OYASU and K. TAKIGAWA. Studies on the wilt disease of broad bean. I. Sci. Rep. Hyogo Univ. Agric. 2: 53-62. 1955. (Japanese. Abs. from English summary.) (Rev. Appl. Mycol. 37: 129. 1958.)

Broad bean wilt and root rot in Japan is associated with infection by Fusarium avenaceum (Fr.) Sacc. f. fabae (Yu) Yamamoto comb. nov., F. oxysporum f. fabae, F. solani f. fabae, and F. graminearum.

199. ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, UGANDA, FOR THE YEAR ENDED 31ST DECEMBER, 1957. 1957. (Rev. Appl. Mycol. 37: 6. 1958.)

Panama disease of bananas (Fusarium oxysporum f. cubense) was found in a new locality. The disease was relatively static in endemic areas. The causal agent of a widespread and destructive damping-off disease of flue-cured tobacco in the Gulu area was identified as Pseudomonas solanacearum var. asiaticum.

## Fungi -- Fusarium -- Resistance

200. BALLARD, J. C. and D. J. DeZEEUW. Spartan Rock -- a new Fusarium wilt resistant muskmelon. Quart. Bull. Mich. agric. Exp. Sta. 40: 822-824. 1948. (Rev. Appl. Mycol. 37: 625. 1958.)

Spartan Rock, resistant to Fusarium oxysporum f. melonis was selected from the $F_8$ generation from Minnesota 10-38 x Howell Honey Rock, after backcrossing $F_1$ & $F_2$ to Honey Rock.

201. CONROY, R. J. Fusarium wilt of rockmelon (Cucumis melo L.) in New South Wales. J. Aust. Inst. agric. Sci., 23: 152-154. 1957. (Rev. Appl. Mycol. 37: 64. 1958.)

The Delicious 51 rock melon is resistant to Fusarium oxysporum f. melonis under conditions inducing severe infection of susceptible varieties.

202. CULBERTSON, J. O. Registration of improved flax varieties VII. Agron. J. 49: 607-608. 1957. (Rev. Appl. Mycol. 37: 237-238. 1958.)
Raja was finally selected in 1952 as resistant to wilt (Fusarium lini).

203. NAIR, P. N. Effect of maleic hydrazide, thiourea, and 2,4-dinitrophenol on resistance to flax wilt. Phytopathology 48: 288-289. 1958. (Rev. Appl. Mycol. 37: 664. 1958.)
The above chemicals were added to a soil-vermiculite medium in which two varieties of flax resistant to wilt (F. oxysporum f. lini) were growing, some of which had been inoculated through the medium. The percentage wilt among treated inoculated plants was greater than among the untreated. In in vitro experiments all the chemicals stimulated growth of the pathogen, especially the higher concentrations of thiourea. There was no correlation between the effect of the chemical on growth in vitro and on the severity of wilt in the plant.

204. OCHSE, J. J. A new banana for Florida -- Musa paradisiaca L., variety Hadja. Proc. Fla. hort. Soc. 70 (1957): 340-341. 1958. (Rev. Appl. Mycol. 37: 669. 1958.)
The author recommends this plantain var., resistant to Panama disease (Fusarium oxysporum f. cubense) and sigatoka (Mycosphaerella musicola.)

**205.** PALMER, JOHN G. and R. L. PRYOR. Evaluation of 160 varieties of Gladiolus for resistance to Fusarium yellows, 1958. Plant Disease Reptr. 42: 1405-1407. 1958.
The selection of resistant varieties was begun by inoculating gladiolus corms with a composite inoculum of six isolates of Fusarium oxysporum Schlecht. f. gladioli (Massey) Snyder & Hansen. Three groups of corms were prepared. Two of the groups were inoculated by rotating over a hardware-cloth grid in sand saturated with a spore and mycelial suspension composed of equal amounts of the Fusarium isolates. Water was used in place of inoculum on the third group. The numbers of germinated shoots and of shoots showing symptoms were recorded twice daily over a period of 14 weeks. Summaries of data indicate that immunity to yellows was not found but that variable degrees of resistance to isolates of the pathogen existed among the varieties of gladiolus.

206. PELLETIER, R. L. and J. SIMARD. (The effects of certain chemical products on the resistance of cabbage to yellows (Fusarium f. conglutinans) (Wr.) Snyder & Hansen.) Rep. Quebec Soc. Prot. Pl. 38 (1956): 40-44. 1957. (Rev. Appl. Mycol. 37: 385. 1958.)
When cabbage plants with type A resistance and others with type B resistance to F. oxysporum f. conglutinans were grown in vermiculite with Gallegly and Walker's nutritive solution with various chemicals, and subsequently inoculated with F. conglutinans by pouring a suspension over the roots, those with type A resistance given p-nitrophenol or 2,4-D had significantly lower disease indices than untreated plants. On the other hand the disease incidence of plants with type B resistance was significantly higher than untreated plants. This suggests that the physiology of plants with type A resistance differs from that of the others.

207. SHIMOMURA, T. et al. Resistance of lotus to the rhizome rot caused by Fusarium bulbigenum Wr. var. nelumbicolum N. et W. (In Japanese with English summary.) Ann. Phytopathol. Soc. Japan 20: 47-53. 1955. (Biol. Abstr. 32: 881. 1958.)

208. YEN, D. E. and I. A. M. CRUICKSHANK. Breeding of peas resistant to Fusarium wilt. N. Z. J. Sci. Tech. 38A: 702-705. 1957. (J. Sci. Food Agr. 9: i-71. 1958.)
Selection of wilt-resistant lines of three varieties of garden and two varieties of field peas is described.

Fungi -- Ganoderma

209. PIRONE, P. D. Ganoderma lucidum, a parasite of shade trees. Bull. Torrey bot. Club, 84: 424-428. 1957.

Sporophores of G. lucidum were present on the trunk bases or roots of nearly 20 percent of dead Norway maples and swamp maples in New York City and Atlantic Highlands, N. J. They were also found on living trees, with branches above the invaded area of trunk either dead or bearing undersized leaves. The pathogenicity of the fungus was indicated by soil inoculation experiments.

Fungi -- Helicobasidium
See also 633

210. SUZUKI, N. et al. Studies on the violet root rot of sweet potatoes caused by Helicobasidium mompa Tanaka. I. The disease invasion under field conditions. Bull. nat. Inst. agric. Sci. Tokyo 8, Ser. C: 1-28. 1957. (Rev. Appl. Mycol. 37: 557. 1958.)

The life history of H. mompa and the symptoms in sweetpotato are described. Infection originates chiefly from overwintering, soil-borne sclerotia. The earlier the planting, the heavier the infection. The pathogen grows on the outside of the sweetpotato from June until the end of Sept., when the hyphae from the infection cushion, formed by hyphal penetration into the middle lamellae of the outer cork layer, penetrate this layer and rot the inner starchy tissues. Resistant varieties either slough off the fungus at the point of infection by the formation of a fresh cork layer or during the period of rapid growth in July-Sept., inhibit further growth of the mycelium once the cork layer has been penetrated.

211. SUZUKI, N. Studies on the violet root rot of sweet potatoes caused by Helicobasidium mompa Tanaka. VI. Histochemical studies of the infected tissues. (1) Chemical changes as results of infection. Bull. nat. Inst. agric. Sci., Tokyo 8, Ser. C: 69-130. 1957. (Rev. Appl. Mycol. 37: 557. 1958.)

SUZUKI, N. and S. TOYODA. VI. (2) Stimulated respiration and behaviour of phosphorus in infected tissues and their relation to defence reaction. Bull. nat. Inst. agric. Sci., Tokyo, 8, Ser. C: 131-173. 1957. (Japanese. English summary.) (Rev. Appl. Mycol. 37: 557. 1958.)

Histochemical studies showed that the resistance of the host is higher when young, decreases at maturity, and even more during storage. Infection causes a decrease of pH due to an accumulation of chlorogenic and caffeic acids, lignification of cell membranes, accumulation of polyphenols in the middle lamellae, formation of a secondary cork layer, and decomposition of cellulose. Other changes in infected cell constituents were noticed.

Fungi -- Helminthosporium
See also 367, 683, 702, 708

212. CLARK, R. V. The evaluation of variability in pathogenicity of Helminthosporium sativum and the relation of temperature to disease development of barley. Diss. Abstr. 17: 220-221. 1957. (Rev. Appl. Mycol. 37: 349. 1958.)

At the University of Wisconsin a comparison of the relative pathogenicity of 50 isolates of H. sativum (Cochliobolus sativus) on six barley varieties in the greenhouse showed differences in the development of seedling blight and root rot. In the course of field tests with five of these isolates, differences in pathogenicity were observed. Seedling blight and rot was severe from 8° to 28° C with a maximum rate of development at 20° C.

213. CLARK, R. V. and J. G. DICKSON. The influence of temperature on disease development in barley infected by Helminthosporium sativum. Phytopathology 48: 305-310. 1958.

In a study using six isolates of the fungus and six varieties of barley it was found that the spot blotch phase of the disease responded differently to

a temperature series than did the root rot and seedling blight phase.

214. DJIEMBAEV, J. T. (Diseases of hard wheat in North Kazakh S.S.R. and their control.) Trud. Resp. st. Zashch. rast. Kazakh. fil. VASKNIL 3: 171-191. 1956. (Abs. from Referat. Zh. Biol. 1957, 18: 182. 1957.) (Rev. Appl. Mycol. 37: 344-345. 1958.)

At the Shortandinskaya Exp. Sta., U.S.S.R., studies from 1949-51 on wheat diseases showed that root rot (Helminthosporium sativum) is especially prevalent in dry summers.

215. LANGE-DE LA CAMP, MARIA. Helminthosporium sativum in Mittel- und Norddeutschland. (Helminthosporium sativum in Central and North Germany.) Phytopath. Z. 32: 167-180. 1958. (Rev. Appl. Mycol. 37: 764-765. 1958.)

Tests at the Institut für Phytopathologie, Aschersleben, Germany, together with field observations, confirmed the occurrence of H. sativum on wheat, barley and rye in Central Germany and on the east edge of the Harz Mountains, and on barley in East Holstein. Physiologic races were detected.

## Fungi -- Itersonilia

216. KEYWORTH, W. G. Plant Pathology Report. Rep. nat. Veg. Res. Sta., Warwick, 7 (1956): 60-64. 1957. (Rev. Appl. Mycol. 37: 1. 1958.)

A. G. Channon in further work on parsnip canker isolated Itersonilia sp. from infected roots from several localities. The fungus readily enters wounded or unwounded roots and the purplish-brown to black, often orange-flecked, lesions produced resemble many naturally occurring cankers.

217. KEYWORTH, W. G. Plant Pathology Report. Rep. nat. Veg. Res. Sta., Warwick, 8 (1957): 48-52. 1958. (Rev. Appl. Mycol. 37: 511. 1958.)

Itersonilia was isolated from over 60 percent of cankered parsnip roots sent in from 53 localities in England and Wales. From five of these localities roots were infected by a Phoma sp. which proved highly pathogenic to parsnips, producing a purplish black lesion closely resembling that of Itersonilia, though often slightly darker. Forms of Itersonilia isolated from diseased chrysanthemum and dahlia florets and other sources but differing from the parsnip isolates in some morphological characters were not pathogenic to parsnips.

218. WALKER, J. Diseases of parsnips. Agric. Gaz. N.S.W. 68: 404-406. 1957. (Rev. Appl. Mycol. 37: 197. 1958.)

Canker (Itersonilia sp.) causes losses of up to 70 percent in autumn-sown crops in the Sydney Metropolitan area. Soft rot (Erwinia carotovora) can be reduced by improved packing conditions.

## Fungi -- Macrophomina

See also 139

219. VERNEAU, R. Nuove matrici dello Sclerotium bataticola (Macrophomina phaseolina). (New hosts of Sclerotium bataticola (Macrophomina phaseolina).) Ric. fitop. Campan., 13-14: 119-124. 1957. (Rev. Appl. Mycol. 37: 371. 1958.)

The isolation of M. phaseolina (M. phaseoli) from tomato plants near Naples and from potato stems, roots, stolons and tubers in 1957 constitutes new host records for Italy. Heavy losses were caused to the potatoes growing on a fine soil which had not been cultivated before.

## Fungi -- Marasmius

220. VIÉGAS, A. P. Podridão das raizes do cafeeiro I, II. (Root rot of coffee. I, II.) Bol. Suptda Serv. Café, S. Paulo, 32, 368: 7-16; 369: 10-19. 1957. (Rev. Appl. Mycol. 57: 536. 1958.

Description of the history, nature, terminology, etiology, external and internal symptoms, and other points of interest connected with a widespread die-back and root rot of coffee (Coffea arabica and its var.) in São Paulo, Brazil, caused by Marasmius viegasii Singer sp. nov., of which a description is given.

Fungi -- Monilochaetes

221. KANTZES, J. G. Nutrition, pathogenicity, and control of Monilochaetes infuscans Ell. and Halst. ex Harter, the incitant of scurf of sweet potatoes. Diss. Abstr. 17: 2394-2395. 1958.

Growth rates of isolates of the causal organism from different locations, on various substrates are recorded. The relative susceptibility of varieties and seedlings of the host was determined in the laboratory by an especially devised technique. A dip treatment prior to planting is essential for control. The best results were achieved with 2 lb./5 gal. thiram, ferbam, or captan, or 1-1000 Puratized Agricultural Spray.

Fungi -- Olpidiaster

222. WICKENS, G. M. Abyan root rot of cotton. Progr. Rep. Exp. Stas. Emp. Cott. Gr. Corp. (Aden), 1956-7, pp. 13-15. 1957. (Rev. Appl. Mycol. 37: 168. 1958.)

Cotton in the Aden Protectorate is affected by a wilt disease (Abyan root rot), the cause of which has not so far been definitely ascertained, but the condition of which is characteristically a root rot. The symptoms and general behaviour of affected plants agree closely with the description of the cotton disease attributed to Olpidiaster gossypii.

Fungi -- Olpidium

223. FRY, P. R. The relationship of Olpidium brassicae (Wor.) Dang. to the big-vein disease of lettuce. N. Z. J. Agric. Res. 1: 301-304. 1958.

Field observations and inoculation experiments suggest that O. brassicae is the cause of big-vein disease of lettuce. Soil treatment with captan, phygon, copper oxychloride, or thiram reduced incidence of the disease.

224. GROGAN, R. G. et al. The association of Olpidium with the big-vein disease of lettuce. Phytopathology 48: 292-297. 1958.

Examination of roots of typically diseased plants from several widely separated locales proved that all were consistently infected with O. brassicae (Wor.) Dang. Lettuce seedlings exposed to Olpidium-infected roots of lettuce or other hosts developed big-vein symptoms. When suspensions of Olpidium zoospores were filtered through filters capable of retaining the zoospores but able to pass a virus, the filtrates did not induce big-vein symptoms. These results indicate a causal relationship between Olpidium and the big-vein disease, which is not contradicted by any proof of virus etiology in the extensive literature on the disease.

Fungi -- Ophiobolus
See also 79, 80

225. GOTTLIEB, DAVID, et al. The resistance of various grasses to Ophiobolus graminis. Plant Disease Reptr. 42: 26-29. 1958.

A number of important grasses grown in Chile were found susceptible to O. graminis in greenhouse studies. The species of Agropyron and Bromus were all very susceptible, whereas Agrostis and Arrhenatherum and Oryzopsis were resistant. In the genera Lolium and Hordeum, the resistance varied with the species.

Fungi -- Pellicularia
see Fungi -- Rhizoctonia

Fungi -- Peronospora

226. RICH, SAUL. Field infection of radish roots with Peronospora parasitica. Plant Disease Reptr. 41: 1058-1059. 1957.
The losses in the second planting, with the beginning of cooler weather, were as high as 75 percent of the radishes harvested on some farms. The discolored areas remained firm, even after prolonged storage.

Fungi -- Phoma

227. KEMP, W. G. A new root rot of florists' chrysanthemums in Ontario. Can. J. Plant Sci. 38: 464-476. 1958.
An apparently undescribed root rot of Chrysanthemum morifolium is described. The disease is characterized by a severe root rot, general stunting, and foliar chlorosis and necrosis. A species of the form genus Phoma was found associated with the roots of the affected plants.

Fungi -- Phytophthora
See also 337, 373, 497, 656

228. ALANDIA, S. and F. H. BELL. Diseases of warm climate crops in Bolivia. F. A. O. Plant Prot. Bull. 5: 172-173. 1957. (Rev. Appl. Mycol. 37: 207-208. 1958.)
An avocado wilt was seen in various localities. Phytophthora cinnamomi has been isolated from the roots of dying trees and is presumed to be the cause of the disease.

229. BINGHAM, F. T., G. A. ZENTMYER, and J. P. MARTIN. Host nutrition in relation to Phytophthora root rot of avocado seedlings. Phytopathology 48: 144-148. 1958.
Avocado seedlings were grown in nutrient solution cultures into which Phytophthora cinnamomi was introduced. The root rot occurred in all treatments but the progress of infection was retarded where high concentrations of N or K had been used. Adaptation of the pathogen to the variations in the environmental conditions in the tests precludes host nutrition as a practical means of control of the disease.

230. BOYCE, A. M. Research and avocado root rot. Calif. Citrogr. 43: 3, 18, 20-21. 1957. (Rev. Appl. Mycol. 37: 295. 1958.)
Phytophthora cinnamomi, the agent of avocado root rot, is very probably not native to California. Well over 100 other hosts are known. The Duke avocado rootstock promises appreciable resistance and selections of this variety are being studied. Vapam is an effective soil eradicant for field use. Soil may also be treated by drying to a moisture content of below 1 percent. When soil is wet and well aerated zoospores are formed in abundance and the disease spreads rapidly. Varying the N, P and K levels has little effect on the fungus.

231. BYFORD, W. J. Phytophthora verrucosa on dahlia. Plant Path. 7: 38. 1958.
In a Border nursery in Scotland dahlia seedlings were affected by a general wilt. Oogonia and oospores of P. verrucosa were observed in the roots. This constitutes a new host record.

232. CALAVAN, E. C. Three major root rot diseases of citrus. Calif. Citrogr. 42: 431-432. 1957. (Rev. Appl. Mycol. 37: 235. 1958.)
Phytophthora citrophthora has been detected in all the important citrus areas in California, causing trunk gummosis, fruit rot, foot rot, root cankers, and destruction of feeder roots. P. parasitica thrives in warm conditions, causing destruction of feeder roots; root rot is especially severe in hot desert areas and in warm locations in intermediate valleys.

233. CHANT, S. R. A die-back of cacao seedlings in Nigeria caused by a species of Phytophthora. Nature 180: 1494-1495. 1957.

Since 1954 a Phytophthora sp., thought to be a form of P. parasitica, has caused considerable losses among cacao seedlings in Nigerian nurseries. About 95 percent control resulted from the application of a proprietary copper fungicide at 3- or 6-day intervals, but at intervals of 9 or 12 days only slight control was obtained.

234. CONVERSE, RICHARD H., et al. Two additional races of Phytophthora fragariae Hickman in Maryland. Plant Disease Reptr. 42: 837-840. 1958.

Five physiological races of Phytophthora fragariae Hickman have been found in Maryland, two of them being previously undescribed.

235. FELIX, E. L. A Phytophthora blight and root rot of strawberry. Plant Disease Reptr. 42: 818-819. 1958.

This Phytophthora, reported from Tennessee, differs in some respects from the red stele fungus, P. fragariae, and resembles the latter in others. Vascular discoloration, as in red stele, has not been observed to date in affected plants.

236. FREZZI, MARIANO. Phytophthora cryptogea causante de la muerte de Populus simonii en Mendoza, Argentina. (P. cryptogea as the cause of death of Populus simonii in Mendoza, Argentina.) Rev. Argentina Agron. 24: 136-143. 1957. (Biol. Abstr. 32: 3467. 1958.)

The fungus P. cryptogea is reported for the first time as a pathogen of the genus Populus. Its morphological, cultural, and biological characteristics are described and illustrated.

237. HERR, LEONARD JAY. Investigations of a Phytophthora root rot of soybeans. Diss. Abstr. 17: 957. 1957.

238. HICKMAN, C. J. Phytophthora -- plant destroyer. Trans. Brit. Mycol. Soc. 41: 1-13. 1958. (Rev. Appl. Mycol. 37: 519. 1958.)

This presidential address comprises a general consideration of the genus under the headings distribution and host range, survival, dispersal, and physiological specialization.

239. HILDEBRAND, A. A. A Phytophthora root and stalk rot of soybeans. (Abstr.) Proc. Can. Phytopath. Soc. 25: 14-15. 1957.

A serious root and stalk rot of soybeans in southwestern Ontario is caused by a fungus tentatively identified as P. megasperma. The first considerable outbreak, in 1954, coincided with the widespread planting of the highly susceptible Harosoy variety. Other varieties including Monroe, remained virtually unaffected. The disease is worst from May until mid-July, but can attack and kill plants throughout the growing season. In culture the causal organism grows at 7.5° to 32.5° C (opt. 25°).

240. HOPKINS, J. C. F. Plant diseases in British colonial dependencies. F. A. O. Plant Prot. Bull. 6: 9. 1957.

In Nigeria a serious wilt disease of seedling cacao is caused by Phytophthora palmivora. Effective control was achieved by 0.3 to 0.5 percent perenox sprays applied at 3-day intervals from germination until 6 weeks of age. In Sarawak a species of Phytophthora, not yet fully determined, has been isolated from root-rot of pepper (Piper nigrum).

241. JOHNSON, E. M. and R. A. CHAPMAN. Unusual occurrence of certain plant diseases in Kentucky in 1958. Plant Disease Reptr. 42: 1411-1413. 1958.

Black shank, Phytophthora parasitica var. nicotianae developed as soon as 2 or 3 weeks after setting of tobacco in some fields. There have been some reports of black shank on farms where there has been no previous report of the disease. Red stele, Phytophthora fragariae, was present in strawberry fields throughout the State.

242. KAUFMANN, M. J. and J. W. GERDEMANN. Root and stem rot of soybean caused by Phytophthora sojae n. sp. Phytopathology 48: 201-208. 1958.

Phytophthora sojae n. sp. is the name proposed for the fungus found

associated with root and stem rot of soybeans in Illinois. A comparison of eight inoculation techniques revealed that two gave quick reliable results.

243. KLOTZ, L. J., T. A. DeWOLFE, and PO-PING WONG. Decay of fibrous roots of citrus. Phytopathology 48: 616-622. 1958.

The importance of Phytophthora citrophthora and P. parasitica as destroyers of fibrous feeder roots of citrus was demonstrated. Environmental factors favouring the parasitism are excess water and organic matter in the soil. Control measures are indicated.

244. KLOTZ, L. J., et al. Guard against introducing brown rot fungi. Calif. Citrogr. 42: 258. 1957. (Rev. Appl. Mycol. 37: 165. 1958.)

Brown rot fungi (Phytophthora spp.) present in the testas of seeds from infected citrus fruits infect nursery seedbeds, and hence, on transplanting, spread to nursery rows. Balled trees from such nurseries constitute an important source of infection on clean land. On the basis of trials in California with seed infected by P. citrophthora and P. parasitica, hot water treatment (4 min. at 120-125° F) is recommended for nursery seed.

245. KLOTZ, L. J., et al. Heat-treat citrus seed to kill Phytophthora brown rot fungi. Citrus Leaves, 37 (5): 14-15. 1957. (Biol. Abstr. 32: 269. 1958.)

Although Phytophthora spp. may be introduced into citrus groves in various ways, an important source is the soil and roots of balled trees. A large percentage of seeds extracted from "brown-rot" fruit carry Phytophthora in the seed coat. It is suggested that seeds be sterilized by 4 minutes immersion in well-agitated water held at 120° to 125° F.

246. KOVACHEVSKI, I. and A. BALEVSKI. (Plant protection in the People's Republic of China.) Bul. Rast. Zash. Sofia, 6: 3-29. 1957. (Tobacco Abstr. 2: 503. 1958.)

A part of this report records the main plant diseases and pests in China and measures for their control. Important diseases noted included Phytophthora parasitica var. nicotianae.

247. MARCELLI, E. Un marciume del piede del tabacco in semenzaio e in campo causato da Phytophthora sp. (A foot rot of tobacco in seedbed and field caused by Phytophthora sp.) Ric. fitop. Campan. 13-14, pp. 125-159. 1957. (Rev. Appl. Mycol. 37: 376. 1958.)

This is an account of a study of a foot rot of tobacco in Italy caused by a fungus which differed from P. parasitica var. nicotianae in its lesser pathogenicity; it is identified provisionally as P. palmivora, not previously recorded on tobacco in Italy.

248. McKEEN, W. E. Red stele root disease of the loganberry and strawberry caused by Phytophthora fragariae. Phytopathology 48: 129-132. 1958.

On Vancouver Island a root decay of loganberry and strawberry is incited by a strain of Phytophthora fragariae, that invariably is closely followed by Pythium spp.

249. MUNGOMERY, R. W. Division of Entomology and Pathology. Rep. Bur. Sug. Exp. Stas. Qd. 57: 66-68. 1957. (Rev. Appl. Mycol. 37: 308. 1958.)

Phytophthora drechsleri caused a wilt of velvet bean (Mucuna deeringiana) in the Mulgrave area of Queensland. The disease had not been encountered previously.

250. NEWHOOK, F. J. Mortality of Pinus radiata in New Zealand. Abs. in Proc. Can. Phytopath. Soc. 25: 16. 1957.

In the serious wilt disease caused by Phytophthora cinnamomi, which is responsible for heavy losses in P. radiata shelter belts in many parts of New Zealand, groups of mature trees die rapidly in spring and early summer after abnormally wet winters following destruction of the absorbing rootlets. Grid sampling showed that the fungus is highly concentrated in the fibrous root zones of the trees.

251. PURSS, G. S. Stem rot: a disease of cowpeas caused by an undescribed species of Phytophthora. Qd. J. Agric. Sci. 14: 125-154. 1957.

The causal organism is a new species, P. vignae Purss, of which a description is given. Excess of water increases disease incidence on lightly infested soil, but is immaterial when soil is heavily contaminated. Seed-borne infection could not be shown.

252. SAREJANNI, J. A. and N. STAMATINI. (Phytophthora of tobacco in Greece.) Benaki Inst. Phytopath. Ann. 1: 51-56. 1935. (Tobacco Abstr. 2: 14-15. 1958.)

This summary points out that the Phytophthora disease of tobacco was first identified in Greece in 1930, but according to growers was probably present much earlier. The fungus corresponds in morphology to the old species, P. nicotianae Breda de Haan. It causes a damping-off of seedlings, a wilting and yellowing of plants in the field, and a leaf spot of full-grown plants.

253. SHOEMAKER, R. A. and D. W. CREELMAN. Thirty-seventh Annual Report of the Canadian Plant Disease Survey, 1957. 132 pp. 1958. (Rev. Appl. Mycol. 37: 515-516. 1958.)

Phytophthora root and stalk rot of soybean in southwestern Ontario (P. ? megasperma) was the most severe for 3 years owing to heavy rainfall and the widespread use of the susceptible Harosoy. The new variety Chippewa was susceptible but Harman was tolerant. Yield reductions in badly affected fields were 18-25 percent. Corynebacterium sepedonicum on potato increased in prevalence in parts of Quebec and Ontario.

254. TEAKLE, D. S. Avocado root rot. Qd. Agric. J. 83: 701-704. 1957.

Avocado trees may be killed by Phytophthora cinnamomi attacking the roots, especially after long periods of wet weather. Because most of the feeder roots are already rotted when decline first shows, it may be difficult to find any containing the fungus.

255. TEAKLE, D. S. Papaw root rot caused by Phytophthora palmivora Butl. Qd. J. Agric. Sci. 14: 81-91. 1957.

The relative pathogenicity of Phytophthora palmivora and Pythium vexans was investigated. The former causes a severe root rot, predisposing factors being waterlogging, high soil temperatures and root damage. Crop rotation and drainage are likely to afford some control.

256. TSAO, PETER H. Serial dilution method for estimating disease potentials of citrus Phytophthoras in the soil. (Abstr.) Phytopathology 48: 398-399. 1958.

A serial dilution method, using lemon fruit as host, was developed that provided means for studying distribution and factors influencing the disease potential of P. citrophthora or P. parasitica in the soil. The disease potential index of a given soil was defined as the reciprocal of the highest of the dilutions that yielded brown rot lesions on the test fruits.

257. WATERHOUSE, GRACE M. Phytophthora citricola Sawada (Syn. P. cactorum var. applanata). Trans. Brit. Mycol. Soc. 40: 349-357. 1957.

Evidence is presented that Phytophthora cactorum var. applanata Chester is synonymous with P. citricola Sawada, which has priority. Also, the latter is sufficiently distinct from P. cactorum to be retained as a separate species.

258. ZENTMYER, G. A. and A. O. PAULUS. Phytophthora avocado root rot. Circ. Calif. Agric. Exp. Sta. 465: 1-15. 1957.

The symptoms are described. Infection may be introduced by the movement of the infected soil or water, the use of infected avocado seeds in nursery stock, or by numerous alternate host plants, which are listed. Measures which help to prevent the spread of the disease or to mitigate its effects are outlined.

259. ZENTMYER, G. A. Prevention of Phytophthora root rot development in new plantings, and other phases of root rot research. Yearb. Calif. Avoc. Soc. for 1957, pp. 55-57.

260. ZENTMYER, G. A. Report on avocado diseases, culture and seed collections in Chile -- June 1956. Agricultura téc., Santiago, 16: 43-46. 1956. (Rev. Appl. Mycol. 37: 295. 1958.)

Root rot of avocado (Phytophthora cinnamomi) was found in the La Cruz and San Vicente areas.

261. ANNUAL REPORT ON THE DEPARTMENT OF AGRICULTURAL RESEARCH, FEDERATION OF NIGERIA, FOR THE YEAR 1956-57, 48 pp. 1958. (Rev. Appl. Mycol. 37: 635. 1958.)

A Phytophthora, which from peculiarities in the structure of the sporangial wall must be regarded either as a new species or as a new variety of P. parasitica, was consistently isolated from Sierra Leone rough lemon stocks and later from Rangpur lime and sweet orange with gummosis disease.

262. JAARVERSLAG 1956 PROEFSTATION VOOR DE FRUITTEELT IN DE VOLLE GROND. (Report for 1956 of the Expt. Sta. for Outdoor Fruit Culture) -- 87 pp., 1957. (Rev. Appl. Mycol. 37: 239-240. 1958.

Both Phytophthora cactorum and P. syringae could be isolated from the soil of an orchard with collar rot.

263. REPORT OF THE DEPARTMENT OF AGRICULTURE, N. S. W., FOR THE YEAR ENDED 30th JUNE, 1956. 111 pp., 1957. (Rev. Appl. Mycol. 37: 133-134. 1958.)

The host range of Phytophthora cinnamomi was extended by 17 new records, mostly on native and ornamental plants, and a number of other records of root and crown rots caused by Phytophthora spp.

264. REPORT ON PHYTOPHTHORA DISEASE. Soybean Digest, 18: 11. 1958.

A warning that Phytophthora may this year cause more than the 1957 loss of 1 1/2 million dollars to Ohio soybeans has been issued by one of the farm papers. The variety Harosoy is particularly susceptible and the disease was found in two out of every three Harosoy fields checked by pathologists of the Ohio Agricultural Experiment Station.

Fungi -- Phytophthora -- Resistance
See also 616

265. BARRIE, A. G. Cowpeas resistant to wilt. Cane Growers' Quart. Bull. 21: 39-41. 1957.

The utility of cowpeas as a green manure crop has been greatly reduced by their susceptibility to wilt caused by Phytophthora sp. A test involving planting dates and varieties showed differences in wilt resistance, and that early planting reduces mortality caused by wilt. Three varieties were found fully wilt-resistant.

266. FLETCHER, W. A. Citrus varieties and rootstocks for New Zealand. Orchard N. Z., 30(11): 9. 1957. (Rev. Appl. Mycol. 37: 353. 1958.)

An additional rootstock known as yuzu (a hybrid of Mandarin and Citrus ichangensis), though somewhat susceptible to Phytophthora root and collar rot, appears to be more drought resistant than sweet orange, which is the least tolerant of drought but seems to be tolerant of or resistant to all the main viruses causing decline.

267. HARRIS, R. V. Plant Pathology. Rep. E. Malling Res. Sta., 1956, pp. 25-30. 1957. (Rev. Appl. Mycol. 37: 131-132. 1958.)

A test of resistance of 29 apple rootstock clones to five isolates of Phytophthora cactorum revealed variation in pathogenicity of the fungus and in rootstock resistance. The pathogen is widely distributed in the soils of

orchards affected by collar rot and is not more highly concentrated round infected trees, but no evidence of mycelial growth in soil was obtained.

268. KLOTZ, L. J. and T. A. DeWOLFE. Possible solution for a basic disease problem. Calif. Citrogr. 43: 80, 85. 1958.

All the rootstocks so far found to be resistant to tristeza (virus) are susceptible to brown rot gummosis (Phytophthora spp.) with the exception of some trifoliate selections. Among these trifoliate selections are two which have recently also been found to show resistance to fibrous root rot caused by the same gummosis fungi followed by secondary organisms. The importance of this finding lies in the fact that all other rootstocks tested, including the sour orange, are susceptible to this form of attack, which is probably responsible for much of the deterioration apparent in many old Californian orchards. The use of trifoliate stock, however, necessitates using exocortis-free budwood, and at present supplies of both stocks and budwood are inadequate. In cases where it is necessary to plant tristeza-resistant, but gummosis-susceptible, stocks on old citrus land, it is important to ensure that both plants and soil are free from gummosis organisms. For soil treatment the best compounds found so far are vapam and mylone, but because of their cost it is suggested that only the tree sites should be treated in a circle 8 feet in diameter. The trees can be planted 1 month after treatment.

269. KLOTZ, L. J. Protecting young trees against brown rot gummosis. Calif. Citrogr., 42: 42. 1956. (Rev. Appl. Mycol. 37: 165. 1958.)

Regarding practical control measures against brown rot gummosis of citrus (Phytophthora spp.) the danger is stressed of the increasing use of susceptible rootstocks to replace sour orange, on account of tristeza virus. Prophylactic measures against the introduction of infection are outlined.

270. McKEEN, W. E. Races of and resistance to Phytophthora fragariae. Plant Disease Reptr. 42: 768-771. 1958.

A report of results of tests for resistance of some common strawberry varieties to 11 different isolates of Phytophthora fragariae.

271. MORTON, GEORGE. Soybean research at Purdue. Soybean Digest 19: 16-18. 1958.

All varieties and strains of soybeans are evaluated for the reaction to Phytophthora root rot and other diseases. Resistance to Phytophthora root rot is being bred into resistant varieties.

272. SIMMONDS, J. H. Science Branch, Plant Pathology Section. Rep. Dept. Agric. Qd., 1956-57, pp. 63-64, 1957. (Rev. Appl. Mycol. 37: 205. 1958.)

The cowpeas C. P. I. 12153, Blackeye 5, Malabar, and C. P. I. 12148 again proved resistant to Phytophthora sp.

273. WOLF, F. A. Notes on tobacco diseases and disorders in Venezuela. Tobacco, N. Y., 145, (2), pp. 20-21, 1957. (Rev. Appl. Mycol. 37: 246. 1958.)

Flue-cured varieties developed in Virginia or North and South Carolina for resistance to Phytophthora parasitica var. nicotianae are found to exhibit almost perfect resistance to or tolerance of the fungus in Venezuela.

274. WOODHEAD, C. E. Collar rot and root rot of Cox's Orange Pippin and other apple varieties. Orchard N. Z., 30: (6): 16-17, 19, 21; (7): 2, 5, 7, 9. 1957.

A survey showed that collar rot (Phytophthora cactorum) is a serious disease of single-worked Cox's Orange Pippin trees in certain orchards. By topworking Cox on other varieties the risk of infection was reduced by at least 75 percent. Defective drainage was dominant in increasing disease incidence.

275. ZENTMEYER, GEORGE A. Resistance to Phytophthora cinnamomi in the genus Persea. (Abstr.) Phytopathology 48: 399. 1958.

In the search for a resistant rootstock, seeds of varieties of avocado

(Persea americana) and of other native species of Persea were collected in Mexico, Central America, Colombia, Ecuador, Peru, Chile, Argentina, Brazil, Venezuela, Trinidad, Puerto Rico, and Cuba. High resistance to P. cinnamomi was found in five small-fruit species of Persea, and moderate resistance was found in two P. americana types. Collections were tested by a rapid, severe method using aerated nutrient solutions; and by the less severe method of planting seedlings in infested soil in greenhouse or lathhouse.

276. ZENTMEYER, G. A. The search for resistant rootstocks in Latin America. Yearbk. Calif. Avoc. Soc. for 1957, pp. 101-106.
Persea spp. were collected in 1956, with particular reference to resistance to Phytophthora cinnamomi.

277. FIFTH ANNUAL REPORT, 1957-8, SCOTTISH HORTICULTURAL RESEARCH INSTITUTE, 51 pp., 1958. (Rev. Appl. Mycol. 37: 697-699. 1958.)
At Auchincruive, each of 36 isolates of Phytophthora fragariae, the cause of red stele of strawberry, fell into 1 of 4 groups as determined by its ability to infect the indicator varieties used. Altogether, 573 plants (strawberry and Fragaria spp.) immune from attack by the Huxley race of P. fragariae were found; many of these appear to be immune also from a second race, but all are susceptible to a third, which infects Climax.

278. FORTY-SEVENTH AND FORTY-EIGHTH ANNUAL REPORTS, 1956, 1957, JOHN INNES HORTICULTURAL INSTITUTION, 47 pp., 1956; 47 pp., 1957. (Rev. Appl. Mycol. 37: 696-697. 1958.)
Survey of parental breeding material of strawberries in 1956 yielded 15 unrelated clones resistant to the common strain of Phytophthora fragariae.

Fungi -- Plasmodiophora
See also 374, 713

279. COLHOUN, J. Club root disease of crucifers caused by Plasmodiophora brassicae Woron. Phytopath. Pap. Commonw. Mycol. Inst. 3, 108 pp. 1958. (Rev. Appl. Mycol. 37: 746. 1958.)
A valuable and comprehensive monograph of the disease.

280. GORLENKO, M. F. (Ed.) (The immunity of plants from diseases and pests.) 212 pp., Agricultural Literature, Moscow, 1956. (Rev. Appl. Mycol. 37: 331-333. 1958.)
Cabbage varieties susceptible to club root (Plasmodiophora brassicae) develop normally and resist the disease when root-grafted with a resistant variety; the contrary is observed with the most resistant variety, Yazik Zwornika, when grafted with a susceptible variety.

281. MAKLAKOVA, G. F. Conditions of club root infection. Doklady vsesojuz. Akad. seljsk. Nauk., 23: 31-36. 1958. (Hort. Abstr. 28: 407. 1958.)
Observations have shown that club root (Plasmodiophora brassicae) attacks both seedlings and older cabbage plants and is affected by environment. For control the following preventive measures are recommended: (1) planting on well drained or elevated land. (2) Planting in groups on the square for good weed control and root aeration. (3) Raising seedlings in frames in peat with AMB or in nutrient blocks which do not contain soil. (4) Inspection of the root system of seed plants before replanting.

282. PLANT DISEASE SURVEY FOR THE TWELVE MONTHS ENDING 30th JUNE 1957. Twenty-seventh Annual Report N. S. W. Dept. Agr. Biological Branch, Division of Science Services, 32 pp. 1957. (Rev. Appl. Mycol. 37: 326-327. 1958.)
Club root (Plasmodiophora brassicae) continues to be severe in crucifers.

283. PLANTESYGDOMME I DANMARK 1955. Årsoversigt samlet ved Statens plantepatologiske Forsøg, Lyngby. (Plant diseases in Denmark 1955. Annual report com-

piled by the State Phytopathological Experiment Station, Lyngby.) Tidsskr. Planteavl, 61: 561-619. 1957. (Rev. Appl. Mycol. 37: 441-442. 1958.)

Club root of cabbage (Plasmodiophora brassicae) was more troublesome and widely distributed than for many years, causing heavy damage in dry field areas.

284. REPORT OF THE ROTHAMSTED EXPERIMENTAL STATION FOR 1957, 316 pp. 1958. (Rev. Appl. Mycol. 37: 630-633. 1958.)

Tests showed that almost all plants of the long radish variety Woods Frame developed symptoms when inoculated with Plasmodiophora brassicae, whereas the Red Forcing turnip radish was highly resistant.

285. THIRTY-SEVENTH ANNUAL REPORT, DEPT. OF AGRIC., CALIFORNIA, FOR THE PERIOD ENDING 31 DECEMBER, 1956. Bureaux of Plant Pathology and Plant Quarantine. Bull. Dep. Agric. Calif. 46: 165-182; 183-190. 1957. (Rev. Appl. Mycol. 37: 206-207. 1958.)

Club root of broccoli (Plasmodiophora brassicae) was found in Humboldt County, this being its first occurrence in the State outside the San Francisco Bay region.

Fungi -- Pyrenochaeta
See also 643.

286. MARLATT, ROBERT B. and R. T. McKITTRICK. Pink-root resistant onions for Arizona. Plant Disease Reptr. 42: 1310-1311. 1958.

Pink root, caused by Pyrenochaeta terrestris (Hansen) Gorenz, J. C. Walker & Larson, was found to be causing losses in scattered plantings through Arizona's Salt River Valley in 1953. Differences in varietal reaction were reported.

Fungi -- Pythium
See also 248

287. FREZZI, M. J. Especies de Pythium fitopatogenas identificadas en la Republica Argentina. (Phytopathogenic species of Pythium identified in the Argentine Republic.) Rev. Invest Agríc., B. Aires 10: 113-241. 1956. (Rev. Appl. Mycol. 37: 337-338. 1958.)

Descriptions are given of 17 species isolated from 140 host species in Argentina, with a key to their identification. P. debaryanum and P. ultimum followed by P. irregulare are the most widespread and the most commonly isolated from a large number of hosts. P. debaryanum was demonstrated by inoculation to cause a virulent potato tuber rot. P. dissotocum was associated with damping-off of white mulberry in a nursery.

P. aphanidermatum caused pea root rot, killing about 40 percent of the plants at the Estación Experimental de Manfredi. It was associated with necrotic stem lesions and rotting of the entire root system of mature Cereus aethiops in a hothouse at the station. It was present with Phytophthora parasitica in necrotic strawberry roots, and was highly virulent to seedlings of Ceratonia siliqua.

Pythium torulosum was isolated only from diseased Piptadenia rigida. P. intermedium caused damping-off of Piptadenia rigida, chilli pepper, tomato, white mulberry. P. graminicola was isolated from dead and chlorotic arrowroot plants. P. periplocum was isolated in conjunction with P. irregulare from date palms with root rot. P. catenulatum was associated with damping-off of tomato, eggplant, red pepper (Capsicum annuum) and Cyamopsis tetragonoloba. P. debaryanum was isolated from groundnut husks and kernels, from root-rots of Arachis pusilla and Cicer arietinum, and from damped-off white mulberry.

Damped-off tomato and red clover and 18-month-old Cupressus horizontalis plants with all their roots rotted yielded Pythium polymorphon. P. rostratum was also present in damped-off tomato and white clover and

was associated with P. irregulare in damping-off of Pinus halepensis. P. ultimum, isolated from 82 hosts, especially seedlings, caused the death of mature hemp and coffee by killing all the roots. P. vexans was isolated from severe root-rot of Begonia rex.

P. irregulare caused root necrosis of various barley varieties. Another strain of the fungus was pathogenic to oats and wheat, destroying entire root systems of 25-day-old plants following inoculation. P. irregulare was responsible also for the damping-off of tobacco and Pinus pinea, root rot and wilt of globe artichoke, root rot of mature kidney beans and salsify, and root rot of mature pea plants.

P. mastophorum was isolated from severely damped-off parsley and cabbage; P. oligandrum from necrotic roots in various safflower lines, from severe root rot of mature plants of Antirrhinum majus, from Phaseolus acutifolium var. latifolius with root rot and stem necrosis, and from pea plants and 1-2-year-old apple trees with dead roots. P. spinosum caused damping-off of Gypsophila sp. and eggplant.

288. HALPIN, J. E. and E. W. HANSON. Effect of age of seedlings of alfalfa, red clover, Ladino white clover, and sweetclover on susceptibility to Pythium. Phytopathology 48: 481-485. 1958.

Seedlings of alfalfa, sweetclover, red clover and Ladino white clover were susceptible to five species of Pythium in sand culture in a greenhouse at 20-23° C, when inoculated at the time of seeding, but were immune when inoculated 3 or more days after seeding. P. debaryanum, P. ultimum and P. irregulare were the most pathogenic; P. splendens was intermediate; P. paroecandrum was least pathogenic.

289. HAMPTON, R. O. Host specialization in Pythium graminicolum and pathogenicity of P. graminicolum to four host species in soil amended with nitrogen and phosphorus. (Abstr.) Iowa State Coll. J. Sci. 32: 184-185. 1957. (Rev. Appl. Mycol. 37: 527. 1958.)

Six isolates of Pythium graminicolum isolated from the roots of maize, Setaria, wheat, barley and rye were grown in continuously cropped and rotation-cropped soils. After the eighth generation the fungus was reisolated and examined for host specialization. The virulence of variety isolates was not significantly influenced by the level of resistance of the crop varieties to which they were exposed. P. graminicolum was not present in the roots of maize plants under 14 or over 132 days old.

290. HAWKER, LILIAN E. et al. Studies on vesicular-arbuscular endophytes. I. A strain of Pythium ultimum Trow in roots of Allium ursinum L. and other plants. Trans. Brit. Mycol. Soc. 40: 375-390. 1957. (Biol. Abstr. 32: 2090. 1958.)

A phycomycetous endophyte, forming typical vesicular-arbuscular mycorrhizas with the roots of Allium ursinum and of some other plants, is described. Pythium ultimum was almost invariably obtained by a section-embedding technique. Inoculation with isolates of Pythium ultimum, under certain conditions, led to typical hyphae and vesicles within the root and, in older seedlings, to the formation of characteristic arbuscules.

291. KENDRICK, J. B. et al. Cantaloupe crown blight study. Calif. Agric. 11 (5): 5-6. 1957.

This publication deals with the geographical distribution of a disease generally associated with decayed roots. Leaves shrivel and die on runners. The trouble occurs where there is winter planting. (See Abstr. No. 300.)

292. LINDBERG, G. D. A serious disease of Melilotus indica associated with soils infected with Pythium. (Abstr.) Phytopathology 48: 395. 1958.

Yields of Melilotus indica, grown as a green manure crop with sugarcane, have been reduced several hundred percent in soils highly infested with Pythium. Two phases of disease were readily apparent: 1) poor stands caused by damping-off with Pythium ultimum, 2) severe stunting, yellowing and premature loss of leaves in affected plants surviving the seedling stage.

293. SCHNEXNAYDER, C. A. and E. V. ABBOTT. Study during 1956 of the effects of stunting disease on yields of cane and sugar in Louisiana. Sugar Bull. N. Orleans 35: 334-339. 1957. (Rev. Appl. Mycol. 37: 56. 1958.)

The fact that seed piece decay caused plant cane stand failure of Louisiana Purple despite treatment demonstrates the continuing importance of seed piece diseases, e.g. red rot (Glomerella tucumanensis) and root rot (Pythium spp.), and the possibility that ratoon stunting favours the development of these pathogens by delaying germination of the seed cutting and the establishment of independent new plants requires further investigation.

294. SHARAN, N. Damping-off of Gul Mohur (Delonix regia Raf.) in India. Plant Disease Reptr. 42: 1408. 1958.

A severe damping-off disease of seedlings of Gul Mohur (royal poinciana) was observed during July 1955 at the Botanical garden at Kanpur. Pythium sp. was isolated and inoculations with this fungus demonstrated its pathogenicity. The causal organism was identified as P. debaryanum.

295. SRINIVASAN, K. V. Current Sci. 25: 299-300. 1956. (Biol. Abstr. 32: 875. 1958.)

Pythium catenulatum Mathews causing sugarcane seedling root rot.

296. TAKAHASHI, M. and S. ITOI. Studies on the mechanism of resistance in the damping-off of cucurbit seedlings. 3. The changes in oxidase activity, polyphenols and ascorbic acid in the seedling tissues of pumpkin inoculated with Pythium ultimum. Bull. Univ. Osaka Pref. Ser. B. 6: 123-125. 1956. (Hort. Abstr. 28: 69. 1958.)

It was found that the activity of oxidase and peroxidase was greater and that polyphenols accumulated more in the affected parts of inoculated seedlings than in healthy tissue. Two days after inoculation the diseased seedlings contained more ascorbic acid and oxidized ascorbic acid than the controls.

297. TEAKLE, D. S. A lucerne root rot caused by Pythium myriotylum. Qd. J. Agric. Sci. 13: 241-243. (Rev. Appl. Mycol. 37: 244. 1958.)

In S. E. Queensland P. myriotylum was found associated with a root rot of lucerne seedlings which resulted in a general unthriftiness of the plants, chlorosis, and progressive defoliation. The fungus proved strongly pathogenic to lucerne seedlings in laboratory inoculation tests, but field attack appeared to be related to the nutrient status of the soil.

298. THOMPSON, H. S. Pythium rot of Saintpaulia. Can. J. Botany 36: 843-863. 1958.

Pythium ultimum readily infected leaf cuttings, rooted cuttings, and the petioles and leaves of plants when these were in contact with moist infested soil. The disease developed over a broad range of moistures and temperatures.

299. VAN DER ZWET, T. The effect of flooding on Pythium root rot in non-sterile soil. (Abstr.) Phytopathology 48: 345-346. 1958.

Severe root rot of sugarcane and maize has been artificially induced by Pythium arrhenomanes only in sterilized soil. Severe root rot was obtained in soil flooded for 72 hours, and flooding 2 days after planting maize seedlings resulted in more infection than flooding before or at planting, or more than 2 days afterwards. Maize planted in flooded soil 2 days after infestation showed 38.5 percent root infection compared with 2.5 percent in the non-flooded control.

300. WEDDING, R. T. et al. Crown blight of cantaloupe. Calif. Agric. 11 (6): 5-7. 1957.

Paper describes a series of studies of the possible causes of the disease, a number of which indicated the inadequacy of the root system. In experiments with both soil temperature and soil moisture as variables, there was a highly significant correlation between crown blight rating and the number of dead roots. Artificial inoculation with several fungi (Fusarium, Pythium, Rhizoctonia, and Sclerotium) associated with cantaloupe roots did

not increase the incidence or severity of the disease. (See Abstr. No. 291.)

Fungi -- Rhizoctonia
See also 74, 627, 650, 717, 719

301. BŁASZCZAK, W. (Studies on rhizoctoniosis of potatoes. I. Studies on rhizoctoniosis of potatoes with special consideration of its control. II. Comparative studies of 25 strains of R. solani Kühn collected in Poland.) Prace Kom. Nauk. roln. leśn Poznán 4 (4): 1-78, 79-114. 1958. (Rev. Appl. Mycol. 37: 676. 1958.)
The first part describes treatment of tubers with 0.1 percent $HgCl_2$. Autumn treatment was more effective than spring treatment. The 25 isolates of R. (Corticium) solani from potato tubers described in part II showed a wide variance in pathogenicity and distinct morphological and cultural differences.

302. FLENTJE, N. T. and H. K. SAKSENA. Studies on Pellicularia filamentosa (Pat.) Rogers. II. Occurrence and distribution of pathogenic strains. Trans. Brit. Mycol. Soc. 40: 95-108. 1957. (Biol. Abstr. 32: 2082. 1958.)
The pathogenicity to five host families of 68 isolates of P. filamentosa and 12 of P. praticola was examined. Strains specialized to particular crops frequently occurred.

303. FLENTJE, N. T. Studies on Pellicularia filamentosa (Pat.) Rogers. III. Host penetration and resistance, and strain specialization. Trans. Brit. Mycol. Soc. 40: 322-336. 1957. (Biol. Abstr. 32: 2088. 1958.)
The methods of infection of several hosts by a root-attacking strain and a number of stem-attacking strains of P. filamentosa were studied with particular attention to formation of appressoria and penetration hyphae.

304. GREEN, V. E. Observations on fungus diseases of rice in Florida 1951-1957. Plant Disease Reptr. 42: 624-628. 1958.
In the Everglades area Rhizoctonia oryzae caused only slight damage. One outbreak of seedling blight (Corticium rolfsii) which killed 10 percent of the plants was arrested by early irrigation.

305. KULMATYCKA, I., P. LESZEZENKO, and K. MALEC. Rhizoctonia disease of potatoes. Acta Agrobot. 3: 27-43. 1955. (Biol. Abstr. 32: 1181. 1958.)
A description of the results of studies on the common potato disease caused by Rhizoctonia solani is preceded by a review of the earlier literature.

306. KURATA, H. and J. NISHIMURA. Studies on the control of Corticium foot-rot of wheat plants. I. Soil conditions and disease incidence. Ann. Phytopath. Soc. Japan 22: 97-102. 1957. (English summary) (Rev. Appl. Mycol. 37: 470. 1958.)
The effects of soil types, manures, and fertilizers on the development of foot rot (Corticium gramineum) were studied. Results showed that least injury occurred to wheat grown in sandy soil to which organic manure, fertilizers, and lime were added. The severity of the disease generally increased with the number of fungi in the soil, while decreasing with an increase of bacteria.

307. LEACH, C. M. and MERLE PIERPOINT. Rhizoctonia solani may be transmitted with seed of Agrostis tenuis. Plant Disease Reptr. 42: 240. 1958.
Rhizoctonia solani, which causes a rapid damping-off of Oregon-grown bentgrass seedlings (Agrostis tenuis), was found to be seed-transmitted.

308. RICH, SAUL. Rhizoctonia root rot on stored horseradishes in Connecticut. Plant Disease Reptr. 42: 554. 1958.
Locally grown horseradish roots developed a firm, fibrous, odourless rot in storage. The rotted tissue was abundantly invaded with the mycelium of R. solani.

309. TEN BOER, H. Het Rhizoctonia problem in Groningen. (The Rhizoctonia problem in Groningen.) Landbouwvoorlichting 15: 70-74. 1958. (Rev. Appl. Mycol. 37: 505. 1958.)

The results of further efforts to solve the problem of infection by Rhizoctonia (Corticium) solani on potatoes in N. Groningen, Netherlands again demonstrated the paramount value of clean "seed".

310. VAN EMDEN, J. H. Waarnemingen betreffende het parasitisme van Pellicularia filamentosa (Pat.) Rogers (= Rhizoctonia solani Kühn) ten opzichte van de aardappelplant. (Observations on the parasitism of Pellicularia filamentosa (Pat.) Rogers (= Rhizoctonia solani Kühn) on the potato plant.) Tijdschr. PlZiekt. 64: 276-281. 1958. (English summary.) (Rev. Appl. Mycol. 37: 736. 1958.)

In field studies at the Instituut voor Plantenziektenkundig Onderzoek, Wageningen, R. (Corticium) solani was often found on symptom-free potato plants; lesions, where present, were restricted to the stems and stolons. The roots of plants growing in vitro in Knop agar inoculated with the fungus were immune from attack until the death of the stems. Temperature and light under which the plants were being grown affected disease incidence.

311. WEBER, GEORGE F. and L. ABREGO. Damping-off and thread blights of coffee in El Salvador. Plant Disease Reptr. 42: 1378-1381. 1958.

New disease manifestations on coffee seedlings in seed beds, caused by Rhizoctonia solani, are described and illustrated. Damping-off of coffee seedlings by Corticium rolfsii is reported for the first time. Silky thread blight of coffee caused by Rhizoctonia ramicola is reported and illustrated, and cultural characteristics of Corticium koleroga are compared with each of the above.

## Fungi -- Rosellinia

312. ABE, T. and M. KONO. Studies on the white root rot of tea bush IV. On the toxicities of cultural filtrate of the fungus. Sci. Rep. Fac. Agric. Saikyo Univ. 8: 74-80. 1956. (Rev. Appl. Mycol. 37: 182. 1958.)

In further cultural studies on Rosellinia (necatrix), isolate R1, no direct correlation was found between mycelial weight and toxicity of culture filtrates from different media, nor between osmotic pressure and toxicity.

313. BONILLA, E. La "llaga negra" del cafeto y su combate. (Black root rot of coffee and its control.) Rev. cafet. Colomb. 14 (134): 35-38. 1958. (Hort. Abstr. 28: 487. 1958.)

Coffee trees affected by the root fungus Rosellinia bunodes were cured by exposing and treating the root collar with 5 gal. per tree of a 1.5 percent suspension of Terraclor.

314. RODRÍGUEZ, RICARDO A. "Torbó", a tropical disease of potatoes. Plant Disease Reptr. 42: 972-980. 1958.

"Torbó", a serious disease of potatoes in Costa Rica, in addition to attacking the tubers, may cause stem canker and root rot with resultant wilting of young plants. The two stages of the disease, which are described as white and black, are caused by a fungus which probably belongs to the genus Rosellinia, and which seems to consist of more than one strain. Terraclor and Vapam were effective as drenches during dry-season conditions, in two applications at a 3-week interval with 250 kilograms and 100 litres per hectare, respectively.

## Fungi -- Sclerotinia

315. PARTYKA, R. E. and W. F. MAI. Nematocides in relation to sclerotial germination in Sclerotinia sclerotiorum. Phytopathology 48: 519-520. 1958.

The nematocide, D-D mixture, increased the incidence of drop of lettuce

caused by Sclerotinia sclerotiorum. The data presented indicates that D-D stimulates stipe formation of sclerotia in treated soil.

Fungi -- Sclerotium
See also 16

316. DUBEY, H. D. Relation of soil texture and occurrence of root rot disease (Sclerotium rolfsii Sacc.) of peanut. Plant Disease Reptr. 42: 1376-1377. 1958.

The root rot disease of peanut caused by Sclerotium rolfsii was much more prevalent in two fields than in other affected fields. These fields were high in sand and low in clay as compared to the heavier textured soils where the disease incidence was low.

Fungi -- Spongospora
See also 665, 666

317. TOMLINSON, J. A. Crook rot of watercress. III. The causal organism Spongospora subterranea (Wallr.) Lagerh. f. sp. nasturtii f. sp. nov. Trans. Brit. Mycol. Soc. (In press).

Fungi -- Stemphylium

318. MUKULA, J. On the decay of stored carrots in Finland. Acta agric. scand., Suppl. 2, 132 pp. 1957. (Rev. Appl. Mycol. 37: 196-197. 1958.)

Contamination of stored carrots by Stemphylium-Fusarium was found to be soil-borne, increasing as the result of successive carrot cultivation in the same field.

Fungi -- Synchytrium
See also 62, 63, 68

319. BOJNANSKY, V. Das Auftreten und Verschwinden des von Schilberszky beschriebenen Kartoffelkrebses, (Synchytrium endobioticum (Schilb.) Perc.) in der Slowakei. (The occurrence and disappearance of potato wart disease in Slovakia.) NachrBl. dtsch. PflSch-Dienst, Berl., N.F. 11: 109-114. 1957. (Rev. Appl. Mycol. 37: 304. 1958.)

Historical data on this disease in Slovakia indicates that it first occurred at Hornany (then in Hungary, now in Czechoslovakia) in 1888, though it was not reported by Schilbersky until 1896. Its subsequent disappearance would appear to have coincided with a dry period from 1890-99. The next reported occurrence was at Kysuce in 1939.

320. FEDOTOVA, T. I., E. F. KARESEVA, and M. I. RAKOVICH. (The difference in the activities of the causal organism of potato wart disease.) (Rep. Lenin. Acad. agric. Sci.), 22: 31-33. 1957. (Rev. Appl. Mycol. 37: 246. 1958.)

At the State Scientific Research Institute for Plant Protection in U. S. S. R. observations have established the existence of 47 potato varieties resistant to wart disease (Synchytrium endobioticum). The greater virulence of isolates from some districts indicates the existence of a new strain of the fungus.

321. GEDZ, S. M. (The importance of vegetative hybridization for increasing immunity of potatoes to wart disease Synchytrium endobioticum (Schilb.) Perc.). (Rep. Lenin. Acad. agric. Sci.) 22: 28-30. 1957. (Rev. Appl. Mycol. 37: 245-246. 1958.)

In field and laboratory trials at the University of Chernovitz, U. S. S. R., potato varieties resistant to wart disease were grafted to susceptible varieties using eyes, roots, and shoots. If the grafting material was treated for 5-6 days with 0.0005 percent heteroauxin solution in cotton wool the results were very satisfactory. The first, second, and third generations of some combinations proved completely resistant.

322. GEDZ, S. M. (On the nature of the immunity of potatoes from wart disease and some

methods for increasing it.) (Agrobiology), 1958: 108-117. 1958. (Rev. Appl. Mycol. 37: 502. 1958.)

In experiments in the Ukraine, with the susceptible potato varieties Ella and Alma growing in soil infested with Synchytrium endobioticum, the spring crop was practically free from infection whereas the autumn one was very severely attacked. On grafting susceptible to resistant varieties, 41 percent of the new combinations were found to be highly resistant; Ella, Epron, and Seyanets 106, each on Ubel, and Seyanets 20 and 24 on Majestic gave good results.

323. MOORE, W. C. The breakdown of immunity from potato wart disease. Outlook on Agric. 1: 240-243. 1957. (Rev. Appl. Mycol. 37: 554. 1958.)

After a brief introduction dealing with the control of the spread of Synchytrium endobioticum by means of import restrictions, the author discusses the occurrence of new physiologic races of the fungus in various geographic locations.

324. MORGAN, G. C., and E. H. PETERS. The potato wart disease problems in Newfoundland. Rep. Quebec Soc. Prot. Pl., 1956, pp. 62-68. 1957. (Rev. Appl. Mycol. 37: 369. 1958.)

In this semi-popular review of potato wart disease (Synchytrium endobioticum), it is stated that sufficient land free from wart is available in the west of Newfoundland for the production of approved seed.

325. MYGIND, H. Kartoffelbrok. En samlet oversigt. (Potato wart. A collective survey.) 58 pp., Statens Plantetelsyn, Copenhagen, 1957. (Rev. Appl. Mycol. 37: 734. 1958.)

This is a useful manual which comprises sections on the symptomatology, etiology, and biology of Synchytrium endobioticum; information on varietal reactions, and on physiological races; the various modes of infection and control.

326. ULLRICH, J. Die physiologische Spezialisierung von Synchytrium endobioticum (Schilb.) Perc. in der Bundesrepublik. (The physiologic specialization of Synchytrium endobioticum (Schilb.) Perc. in the Federal Republic.) Phytopath. Z., 31: 273-278. 1958. (Rev. Appl. Mycol. 37: 502. 1958.)

Five varieties and two strains of potatoes were used as differential varieties at the Institut für physiologische Botanik, Brunswick, for the identification of five biotypes of S. endobioticum found in Germany.

(327. No abstract for this number.)

Fungi -- Verticillium

See also 65, 69, 72, 76, 662, 695, 710, 724

328. BATES, G. R. Botany and Plant Pathology. Rep. Minist. Agric. Rhod., Nyasald. 1955-6, pp. 79-86. 1956. (Rev. Appl. Mycol. 37: 134-135. 1958.)

Verticillium dahliae was responsible for wilt of tomatoes under glass and was associated with wilt symptoms in eggplant and okra.

329. BURTON, C. L. and D. J. DeZEEUW. Studies on transmission of Verticillium wilt of eggplant in Michigan. Plant Disease Reptr. 42: 427-436. 1958.

Laboratory results indicate that seed transmission of Verticillium wilt of eggplant is unlikely to occur in practice.

330. BUXTON, E. W. Problems of plant wilt diseases. Agric. Rev. 3 (7): 28-35. 1957. (Rev. Appl. Mycol. 37: 450. 1958.)

A survey presents up-to-date information under the headings of Verticillium wilt, Fusarium wilt, wilt problems in Britain, research problems, and control methods.

331. DAVIES, R. R. and I. ISAAC. Dissemination of Verticillium albo-atrum through the atmosphere. Nature 181: 649. 1958. (Rev. Appl. Mycol. 37: 497. 1958.)

Following the trapping of colonies of V. albo-atrum on agar plates in a lucerne stand and the isolation of this fungus from house dust in Edinburgh and from the atmosphere in a garden in London, an investigation was initiated to determine the number of V. albo-atrum spores in the air within and above lucerne crops at four centres. The results indicate that the number of spores of V. albo-atrum in and above infected stands of lucerne is sufficiently high to suggest that the spread of the disease in this crop may occur by means of wind-blown spores.

332. DAVIS, J. F., R. E. LUCAS and L. N. SHEPHERD. Mint grown on organic soils. Better Crops 41 (10): 28-36. 1957. (Hort. Abstr. 28: 261. 1958.)

Yields of mint are depressed by wilt disease (V. albo-atrum) in Michigan. Large responses to fertilizers were obtained. Under dry or frosty conditions irrigation is advisable and this may induce wilt attack. Transplanting is less effective than planting roots because wilt injury is more likely. Wilt increases with prolonged production without rotation.

333. EDGINGTON, L. V. Temperature and nutritional studies on Verticillium and Fusarium wilts of tomato. Diss. Abstr. 17: 22-23. 1957. (Rev. Appl. Mycol. 37: 316. 1958.)

A decrease in either B or Ca caused an increase in susceptibility of tomato plants to F. oxysporum lycopersici, but when B was increased to 10 ppm to give toxicity symptoms wilt became more severe than with the optimum (0.05 ppm). In a water culture experiment both a deficiency and an excess of Mn increased susceptibility.

334. ELENKOV, E. (Morphological changes in sweet peppers affected by Verticillium wilt.) Bull. Plant Prot., Sofia 3 (1954): 39-41. 1955. (Rev. Appl. Mycol. 37: 435. 1958.)

A disease of sweet peppers (Capsicum) in S. Bulgaria caused dwarfing of the plants and losses up to 90 percent in 1951. The pathogen, V. albo-atrum, proved to be serious only when parasitizing young plants before transplanting. Diseased plants then attain only 1/4 the height of normal ones, produce little fruit, and often wither in hot weather.

335. ERWIN, DONALD C. Verticillium wilt of Cicer arietinum in southern California. Plant Disease Reptr. 42: 1111. 1958.

Since 1954 in the San Pedro Hills of Los Angeles County, California, a wilt disease of garbanzo bean plants (Cicer arietinum) incited by Verticillium albo-atrum Reinke & Berth. has occasionally been seen. Foliage of affected plants was yellow in color and eventually plants wilted and died. A light brown discoloration of the xylem tissue was also present in infected plants.

336. GREEN, RALPH J., Jr. Deep plowing for controlling Verticillium wilt of mint in muck soils. Phytopathology 48: 575-577. 1958.

Verticillium albo-atrum var. menthae was absent below 12-18 inches or present in very low concentrations in muck soils. When the upper 12-14 inches of soil was dropped into the previous plow furrow before the remainder of the soil was turned to a depth of 28-32 inches, wilt incidence was reduced.

337. HARRIS, R. V. Plant Pathology. Progress in research on Verticillium wilt and virus diseases in hops in 1957. Rep. E. Malling Res. Sta., 1957: 22-27; 161-163. 1958. (Rev. Appl. Mycol. 37: 439. 1958.)

In preliminary experiments Phytophthora cactorum affected the growth of susceptible apple varieties in infested soil by attacking the fibrous roots without actually causing collar rot. There was a definite seasonal activity of the fungus in the soil.

Further studies on the mechanism of resistance in hop varieties tolerant of V. albo-atrum indicated that the deposition of suberin in the host cell walls may prevent cellulose-destroying enzymes produced by the pathogen from attacking the walls. Complete exclusion of V. albo-atrum could not be achieved by this means alone owing to the zone of immature cells near the

root tip which would lack suberin at this stage. Following the death of infected plants, V. albo-atrum sporulated over the root surface and occasionally on soil particles adhering to the root, but mycelial growth into the soil was very limited. In inoculations of the susceptible variety Fuggle, wilt symptoms developed more rapidly when bine fragments were used than with spore suspensions and the rate of development was related to inoculum concentration. Conidia of the wilt fungus remained viable in soil for the duration of a 14-day test. Every soil investigated inhibited the germination of conidia.

338. HUGHES, C., N. D. FULTON and B. A. WADDLE. Irrigation and Verticillium wilt incidence in cotton. Arkansas Farm Research 7 (2): 4. 1958.

Data showed a significant increase in wilt incidence in irrigated replications of 5 varieties. Increases in wilt ranged from 15 to 26 percent.

339. KIESSIG, R. and RENATE HALLER-KIESSIG. Beitrag zur Kenntnis einer infektiösen Welkekrankheit der Luzerne (Verticillium albo-atrum R. et B.). (Contribution to the knowledge of an infectious wilt disease of Lucerne (Verticillium albo-atrum R. et B.).) Phytopath. Z. 31: 185-222. 1957. (Rev. Appl. Mycol. 37: 416-417. 1958.)

A comparison of the symptoms of arid wilt with those of the three known wilt diseases of lucerne at Jena, Germany, showed that there was considerable agreement between it and Fusarium wilt (Fusarium sp.) and with Verticillium wilt. Each of these diseases produces a number of symptoms that are similar for all three, whereas the root symptoms of arid wilt are quite different from those produced by an infection with Corynebacterium insidiosum. The root symptoms of arid wilt are indistinguishable from those of the Fusarium and Verticillium wilts. However, numerous isolation and infection tests proved that V. albo-atrum is the pathogen. Four strains of V. albo-atrum produced two toxins with different effects and properties.

340. MOREAU, MIREILLE. (The development of the lignifying complex in the cultivated carnation during attack by Phialophora cinerescens.) Rev. Mycol., Paris, 22: 155-165. 1957. (Rev. Appl. Mycol. 37: 86. 1958.)

Attack of carnation by Phialophora (Verticillium) cinerescens produced an effect on lignification that inhibited locally the formation of the woody ring and caused a regression of the tissues already lignified. At a distance, lignification was increased with an accompanying weak but normal differentiation and lignification of the vessels of new tissues. Gummosis seems to be a defence reaction of the host. As gummosis spreads in living tissues, the annular arrangement of the lignified tissues may prevent it from exerting a fatal effect on the cells and allow the development of subero-phelloderm which may, temporarily at least, hinder the advance of the parasite. This may explain the different degrees of resistance of varieties previously classified according to the anatomical character of their xylem, the growth of which and the induration of the parenchyma associated with gummosis account for the stiff, brittle habit of infected carnations.

341. MOREAU, MIREILLE. (The ligneous tissue of the collar and susceptibility of the cultivated carnation to vascular parasites.) Bull. Soc. bot. Fr., 104: 257-259. 1957. (Rev. Appl. Mycol. 37: 481. 1958.)

Four types of distribution of woody tissues are distinguished: in type I, where the tissues are in continuous concentric rings surrounded by sclerified cells, an effective mechanical barrier is presented to heavy attack by Phialophora (Verticillium) cinerescens; in type IV lignification is reduced and the woody tissues are in islands running radially. Varieties were found to be differentially susceptible to fusariosis and to verticilliosis.

342. NATTI, J. J. Verticillium wilt of broccoli and cauliflower in New York. (Abstr.) Phytopathology 48: 264. 1958. (Rev. Appl. Mycol. 37: 612. 1958.)

Seedlings of 15 varieties of broccoli and three of cauliflower the roots

of which were dipped in a culture of V. albo-atrum isolated from tomato, developed yellowing, often unilateral, of the lower leaves and blackening of the vascular strands within 14-30 days in the greenhouse. Similar symptoms occurred in field plots known to be infested with this pathogen. Infected plants were not stunted nor were yields affected. Broccoli plants inoculated with isolates from naturally infested broccoli and cauliflower developed similar symptoms to those caused by the tomato strain.

343. NELSON, PAUL E. and STEPHEN WILHELM. Thermal death range of Verticillium albo-atrum. Phytopathology 48: 613-616. 1958.

Minimum exposure and lethal temperature in hot water for a rose and a tomato isolate of V. albo-atrum was 5 minutes at 47° C for hyphae and conidia and 10 min. at 50° C for microsclerotia. A 40-min. exposure at 47° C also killed microsclerotia. Microsclerotia exposed in dry atmosphere at 49-50° C survived 6 months whereas conidia succumbed within 3 days.

344. NOVELLO, C. Segnalazione di Verticillium sp. su Cannabis sativa. (Report of Verticillium sp. on Cannabis sativa.) Ric. fitop. Campan. 13-14: 161-163. 1957. (English summary.) (Rev. Appl. Mycol. 37: 356. 1958.)

An unidentified Verticillium sp. causing wilt of hemp near Naples is the first recorded report in Italy.

345. PAPAÏOANNOU, A. J. Une hadromycose du pistachier (Pistacia vera L.) causée par le Verticillium albo-atrum Reink. and Berth. Ann. Inst. Phytopath. Benaki 10: 25-27. 1956. (Biol. Abstr. 32: 1778. 1958.)

P. vera is reported as a new host of V. albo-atrum for the first time in Greece.

346. PHILLIPS, D. H. Report of the Mycological Dept., 1955. Rep. States Jersey 1955: 31-42. 1957. (Rev. Appl. Mycol. 37: 4. 1958.)

More outbreaks than usual of Verticillium wilt (mostly V. albo-atrum) were noted on glasshouse tomatoes.

347. PRATT, M. J. Occurrence, behavior and control of Verticillium albo-atrum Reinke and Berth. on small fruits. Diss. Abstr. 18: 36-37. 1958. (Hort. Abstr. 28: 562. 1958.)

Verticillium wilt was found to be an important disease of black raspberries and strawberries in Oregon. Plant remains in the soil are a serious source of infection but incidence of Verticillium in propagation stock was low. Complete control in the top 10 inches of soil was obtained in field trials with allyl bromide, chloropicrin, Mylone, and Vapam at about 400 lb./acre.

348. RAABE, ROBERT D. and STEPHEN WILHELM. Verticillium wilt of garden stock (Matthiola incana). Phytopathology 48: 610-613. 1958.

Verticillium wilt of garden stock, Matthiola incana, was prevalent in northern and southern California. Symptoms, including a yellowing and wilting of the lower foliage, are very similar to those of K deficiency, and in some ways resemble those of Fusarium wilt, Rhizoctonia foot rot, bacterial blight, and Phytophthora foot rot.

349. ROBINSON, D. B., R. H. LARSON and J. C. WALKER. Verticillium wilt of potato in relation to symptoms, epidemiology and variability of the pathogen. Wisconsin Agric. Expt. Sta. Res. Bull. 202: 1-49. 1957. (Biol. Abstr. D, 32: 1176. 1958.)

In this research program on Verticillium wilt of potato a severe tuber lesioning was shown to be associated with Verticillium wilt. Evidence was obtained that these tuber lesions were incited by a species of Pseudomonas.

350. ROSS, J. P. Studies on the chemotherapy and physiology of the Verticillium diseases of peppermint and chrysanthemum. Diss. Abstr. 17: 11. 1957. (Rev. Appl. Mycol. 37: 286-287. 1958.)

Healthy chrysanthemums and peppermint plants previously inoculated with V. albo-atrum by allowing them to take up spores from a suspension were tested with 27 chemotherapeutants absorbed through the freshly-cut basal ends. Fungichromin and Nabam proved most effective. The amino-N content of healthy and infected cuttings was compared.

351. SEWELL, G. W. F. and J. F. WILSON. Weed hosts of the "progressive" hop strain of Verticillium albo-atrum Reinke and Berth. Rep. E. Malling Res. Sta. 1957, pp. 126-128. 1958. (Rev. Appl. Mycol. 37: 498. 1958.)

Isolates of V. albo-atrum, very virulent on hop, were isolated from four common weeds, Chenopodium album, Senecio vulgaris, Solanum nigrum, and annual nettle (Urtica urens), in badly wilted hop gardens. After the first appearance of wilt in these gardens the weeds are usually allowed to grow unchecked until picking time, when they are cut down and ploughed in, because repeated cultivation has been found to increase spread. Two conflicting factors concerned are the beneficial effect of an annual weed flora in reducing the period of survival of V. albo-atrum in dead tissues, and the possible harmful effect of living hosts in which the pathogen can persist.

352. SKOTLAND, C. B. and J. D. MENZIES. Two peppermint diseases found in the Yakima Valley of Washington. Plant Disease Reptr. 41: 493. 1957. (Biol. Abstr. 32: 2955. 1958.)

In 1955 a wilt disease of peppermint, Mentha piperita, associated with Verticillium albo-atrum caused considerable damage in one field in the Yakima Valley. This is the first reported occurrence of the typical strain in Washington, and on the genus Mentha.

353. STEPANTSEV, I. N. (Diseases causing cotton wilt and their control.) Bull. Bur. nat. Sci. Tadzhik S.S.R. 21: 89-107. 1957. (Rev. Appl. Mycol. 37: 662-663. 1958.)

A detailed study in 1941-1954 on cotton wilt in the Leninabad region caused by Verticillium (dahliae) showed that temperature and humidity play the most important role in its development. 25.2°C is opt., and 36.8° max. With 13.5-19.3 percent humidity the disease becomes epidemic. With the thin lint cotton varieties the wilt caused by Fusarium (vasinfectum) appears only when the temperature is less than 36.8°, the opt. being at 29°. Rotation of cotton and lucerne proved very successful. Irrigation must be done before the temperature reaches 38.7°. B and Mn applied before sowing increased the respiratory capacity of plants and their resistance to wilt.

354. TALBOYS, P. W. Mechanisms contributing to Verticillium-resistance in the hop root. Trans. Brit. Mycol. Soc. 1958, 41: 227-241. (J. Sci. Food Agr. 9: ii-169. 1958.)

Invasion of the host root is retarded by cell-wall lignification and by occlusion of invading hyphae by sheathing deposits. Suberization of the endodermis excludes the fungus from the stele.

355. TALBOYS, P. W. Some mechanisms contributing to Verticillium-resistance in the hop root. Degradation of cellulose by Verticillium albo-atrum. Association of tylosis and hyperplasia of the xylem with vascular invasion of the hop by Verticillium albo-atrum. Trans. Brit. Mycol. Soc., 41: 227-241; 242-248; 249-260. 1958. (Rev. Appl. Mycol. 37: 673-674. 1958.)

The reactions of the hop cultivar tolerant of virulent and mild strains of V. albo-atrum and the sensitive Fuggle were studied. Observations on host-parasite interactions in the determinative phase are described in detail. Exclusion of the fungus from the stele apparently depends on suberization of the endodermis. The defence mechanism in the hop is of a type found in other plants, related, it is suggested, to the presence of foreign organisms.

In the second paper is reported the secretion of a cellulase system by the fungus in liquid media containing cellulose or cellobiose as the sole C sources. From results obtained it is suggested that the presence of sugars, starch, etc. in roots invaded by V. albo-atrum can inhibit cellulase production and general cell-wall destruction, though traces of cellulase still

aid fungal penetration.

In the third paper tylosis was shown to be stimulated by the presence of small amounts of mycelium and low concentration of the metabolites secreted by the pathogen but is inhibited by higher concentration. Tylosis and hyperplasia are also induced in the hop by V. dahliae and other fungi and by wounding. Leaf necrosis and the preceding chlorosis and browning of mesophyll cells adjacent to terminal tracheidal elements are probably due to fungal toxins in both mild and acute syndromes.

356. ZALESKI, A. Reactions of lucerne strains to Verticillium wilt. Plant Path. 6: 137-142. 1957. (Rev. Appl. Mycol. 37: 297-298. 1958.)

Twelve lucerne strains became naturally infected by V. albo-atrum, some more severely than others. Symptoms became more conspicuous towards the end of the season and the disease spread more as the stands aged.

357. THIRTY-FIRST ANNUAL REPORT OF THE DEPT. OF SCIENTIFIC AND INDUSTRIAL RESEARCH, NEW ZEALAND, 1957. (Rev. Appl. Mycol. 37: 7. 1958.)

Although Verticillium wilt of tobacco spreads very slowly it is becoming an increasingly important problem.

Fungi -- Verticillium -- Resistance

358. ELENKOV, E. (On the relation between sweet pepper varieties and Verticillium wilt.) Bull. Plant Prot., Sofia 6: 32-37. 1957. (Rev. Appl. Mycol. 37: 435. 1958.)

The relative resistance of 115 varieties of sweet pepper to Verticillium albo-atrum was determined in inoculated soils under greenhouse conditions or by dipping the split roots of plants into a culture suspension.

359. MILLER, P. W. and G. F. WALDO. Relative resistance of some strawberry varieties and selections to powdery mildew at Corvallis, Oregon. Plant Disease Reptr. 41: 23-24. 1957. (Biol. Abstr. 32: 880. 1958.)

Most clones of the native strawberry species, Fragaria chiloensis, are resistant or tolerant to Verticillium wilt caused by V. albo-atrum.

360. NEWTON, W. and M. C. J. VAN ADRICHEM. Resistance to Verticillium wilt in $F_1$ generations of self-fertilized species of Fragaria. Can. J. Botany 36: 297-299. 1958. (Biol. Abstr. 32: 2669. 1958.)

The $F_1$ generations of selfed plants of Fragaria chiloensis, F. ovalis, and F. yukonensis contained seedlings resistant to the Verticillium wilt disease. Selfed F. orientalis plants yielded seedlings that carried considerable tolerance, but selfed F. vesca, F. bracteata, and F. virginiana plants yielded neither tolerant nor resistant seedlings. Asexually propagated plants of the seven species were all susceptible to the disease.

361. PUTT, E. D. Note on resistance of sunflowers to leaf mottle disease. Canad. J. Pl. Sci. 38: 274-276. 1958. (Rev. Appl. Mycol. 37: 549. 1958.)

At Morden, Manitoba, 40 varieties and lines of sunflower were grown in soil infected with V. albo-atrum. A low percentage of leaf mottle was recorded on three lines. Preliminary results indicated the complex nature of the inheritance of resistance to this disease.

362. VAN ADRICHEM, M. C. J. and W. R. ORCHARD. Verticillium wilt resistance in the progenies of Fragaria chiloensis from Chile. Plant Disease Reptr. 42: 1391-1393. 1958.

Seedlings of Fragaria chiloensis collected in Chile were tested for resistance to the Verticillium wilt disease caused by V. albo-atrum Reinke & Berth. Resistant plants were found in three of eight collections and tolerant plants in all but one. The suggestion is advanced that the resistance in certain cultivated varieties may have been introduced through F. chiloensis from North and South America and that by selfing certain cultivated varieties resistant lines may be isolated.

## INSECTICIDES

See also 690

363. ERWIN, DONALD C. and H. T. REYNOLDS. The effect of seed treatment of cotton with Thimet, a systemic insecticide, on Rhizoctonia and Pythium seedling diseases. Plant Disease Reptr. 42: 174-176. 1958.

In soil infested with Rhizoctonia solani Thimet as a seed treatment increased the percentage emergence and appeared to be fungitoxic. In soil infested with Pythium debaryanum Thimet did not increase the percentage of emergence. Treatment of seed with a Thimet-captan mixture or with Thimet following an initial seed treatment with captan was found to induce a satisfactory stand of cotton in non-sterilized soil.

## METHODS AND TECHNIQUES

364. BARTON, R. Occurrence and establishment of Pythium in soils. Trans. Brit. Mycol. Soc. 41: 207-222. 1958.

In studies at Botany Dept., University of Manchester, of 25 soil samples from different parts of Britain, P. mammillatum was isolated from 2 (vegetable garden and oat fields), P. debaryanum from 3 (flower garden, greenhouse and potato fields), and P. ultimum from 4 (vegetable garden, wheat field and beds), using susceptible seedlings as "baits". The behaviour of Pythium in relation to pH, moisture content, nutritional status, and texture of cultivated soils and acid woodland soils was investigated by means of susceptible host baits and glass fibre tape technique. The presence of suitable host plants proved an important factor in establishing Pythium in soils. It was indicated that pH affects the life cycle of Pythium in soils.

365. BROWN, M. E. Preliminary studies on the inoculation of selected microorganisms into partially sterilized soils. J. Gen. Microbiol. 18: 239-247. 1958.

At the end of 1 year Nocardia cellulans was still present in high numbers in partially sterilized soils while it disappeared from an untreated soil in 6 months.

366. BUTLER, EDWARD E. and RICHARD B. HINE. Use of novobiocin for isolation of fungi from the soil. Soil Science 85: 250-254. 1958.

Novobiocin, sodium acid salt, when used in a concentration of 100 $\mu$g/ml in potato-dextrose agar, pH 5.6-6.1 excluded bacteria and actinomycetes from soil dilution plates but allowed fungi to grow. The only fungi which failed to produce colonies on novobiocin-PDA were a limited number of species in the genera Phytophthora and Pythium.

367. CHINN, S. H. F. and R. J. LEDINGHAM. Application of a new laboratory method for the determination of the survival of Helminthosporium sativum spores in soil. Can. J. Botany 36: 289-295. 1958.

A laboratory method is described for determining the survival of Helminthosporium sativum spores in soil.

368. GILMOUR, C. M., L. DAMSKY and W. B. BOLLEN. Manometric gas analysis as an index of microbial oxidations and reductions in soil. Can. J. Microbiol. 4: 287-293. 1958.

A manometric procedure for the determination of microbial oxidations and reductions in soils is described.

369. GOULD, CHARLES. J. The use of tiles for studies on soil-borne fungi. Plant Disease Reptr. 42: 811-813. 1958.

The use of concrete sewer tiles has proven very useful for certain types of field studies on soil-borne pathogens of gladiolus; namely Stromatinia gladioli (Dray.) Whet., Sclerotium rolfsii Sacc., and an unnamed (black rot) fungus. This equipment was used to study longevity of pathogens in different soil types, the effectiveness of different kinds of fungicides, the effectiveness

of different methods of fungicide application, and the persistence of fungicidal action in the soil.

370. ISHIZAWA, S. et al. Studies on microbial population in the rhizosphere of higher plants, with special reference to the method of study. Soil and Plant Food (Tokyo) 3: 85-94. 1957. (Chem. Abstr. 52: 7950 (i). 1958).
Fungi counts were generally greatest in the rhizosphere of timothy and least in the rhizosphere of alfalfa.

371. JAMES, N. Soil extract in soil microbiology. Can. J. Microbiol. 4: 363-370. 1958.
In this study soil extract was considered critically in so far as various treatments affect numbers of bacteria developing on soil-extract agar.

372. KERR, A. The use of cellophane in growth studies on soil fungi. Trans. Brit. Mycol. Soc. 41: 14-16. 1958.
A cellophane disk technique is described which has been used to demonstrate a stimulation of Pellicularia praticola by fresh grass cuttings. The technique has limitations, in that the behaviour of a fungus between sheets of cellophane may be very different from that in the surrounding substrate.

373. KLOTZ, L. J. and T. A. DeWOLFE. Techniques for isolating Phytophthora spp. which attack citrus. Plant Disease Reptr. 42: 675-676. 1958.
P. citrophthora, P. parasitica, and P. syringae have been isolated from soil samples in the laboratory (Univ. of Calif. Citrus Expt. Sta., Riverside) by saturating with water, placing clean lemons on the surface to trap the zoospores, and incubating at 20°C. In the field a lemon or an orange is placed in a can with a drain hole and wire bail, buried 6-12 in. under the soil surface or in irrigation furrows. Depending on soil temperature, 4-10 days after irrigation or rain the cans are pulled out and isolations made from fruits with brown rot.

374. MacFARLANE, I. A solution-culture technique for obtaining root-hair, or primary, infection by Plasmodiophora brassicae. J. Gen. Microbiol. 18: 720-732. 1958.
Primary infections were obtained by growing cabbage seedlings in a modified-Hoagland's solution in which resting spores of P. brassicae were suspended. A roughly linear relationship was found between the logarithm of number of infections/roots and the logarithm of spore concentration in the medium. Infection was not affected by changing from pH 5 to 6 but was greatly decreased at pH 8.

375. MACURA, J. and I. MALET. Continuous-flow method for the study of microbiological processes in soil samples. Nature 182: 1796-1797. 1958.
The method described makes it possible to introduce into the soil continually any desired amount of substrate the transformation of which is studied. Basically it is an application of the continuous-flow method of culture microorganisms to the study of microbiological processes in the soil.

376. MALOY, O. C. and M. ALEXANDER. The "most probable number" method for estimating populations of plant pathogenic organisms in the soil. Phytopathology 48: 126-128. 1958.
A technique involving the use of the most probable number method was adapted to the estimation of two plant pathogenic fungi, Fusarium solani f. phaseoli and Thielaviopsis basicola, in the soil.

377. MENZIES, J. D. A dipper technique for serial dilution of soil for microbial analysis. Soil Sci. Soc. Amer., Proc. 21: 660. 1957.
A stainless steel cup of 1-ml capacity is used in place of pipettes for serial dilutions of soil suspensions in test tubes.

378. PARK, D. The saprophytic status of Fusarium oxysporum causing vascular wilt of oil palm. Ann. Botany, N.S. 22: 19-35. 1958.

The droplet method described, especially when used in conjunction with a baiting technique, facilitates the demonstration of Fusarium oxysporum in soil.

379. PETERSON, E. A. Observations on fungi associated with plant roots. Can. J. Microbiol. 4: 257-265. 1958.

The soil fungal flora associated with plant roots is influenced by the age of the plants and the soil type.

380. SLANKIS, V. An apparatus for surface sterilization of root tips. Can. J. Botany 36: 837-842. 1958.

An apparatus for surface sterilization of root tips is described. This apparatus makes sterilization more accurate and considerably more efficient compared with methods previously employed. It can be successfully used under field conditions.

381. STENTON, H. Colonization of roots of Pisum sativum L. by fungi. Trans. Brit. Mycol. Soc. 41: 74-80. 1958.

The colonization of pea roots by soil fungi was investigated by sowing surface-sterilized seeds in pots of garden soil and sampling at intervals over a period of 87 days. Over 40 different fungi were isolated. Cylindrocarpon was the most abundant, occurring 635 times and equally frequent on upper and lower root sections. Species of Fusarium were isolated 278 times, Pythium 119, Gliocladium roseum 107, Mortierella 73.

382. STEVENSON, I. L. The effect of sonic vibration on the bacterial plate count of soil. Plant and Soil 10: 1-8. 1958.

Treating the first dilution of a soil-plating series by high-frequency vibrations resulted in initial increases in the numbers of bacteria, actinomycetes, and fungi appearing on plates.

383. THORNTON, R. H. A soil fungus trap. Nature 182: 1690. 1958.

An improved screened immersion-plate method for isolating soil fungi is described.

384. WAID, J. S. Distribution of fungi within the decomposing tissues of rye grass roots. Trans. Brit. Mycol. Soc. 40: 391-406. 1957.

Rye grass roots, classified according to the degree of visible decomposition of the cortex, were plated. The progress of root degradation was paralleled by an increase in fungal activity in each zone. The most active population originated from the root surface of intact roots.

## NEMATODE CONTROL

See also 628

### Nematode control -- Crop Rotation

See also 428

385. MASLENIKOV, I. P. (Control of onion nematode) (Russian) Sad i Ogorod. 5: 27-28. 1958. (Hort. Abstr. 28: 604. 1958)

Control of onion nematode by crop rotation, hot water treatment of the seed, ammonium nitrate top dressing, or soil treatment with dichloroethane was discussed.

386. MEIJNEKE, C. A. R. and M. OOSTENBRINK. Tagetes ter bestrijding van aaltjesaantastingen. Overdruk uit Mededelingen Directeur van de Tuinbouw 21: 283-290. 1958.

It is shown that several cultivars of Tagetes patula and T. erecta reduce the population of certain root infesting nematodes such as Pratylenchus spp., Tylenchorhynchus spp., Rotylenchus robustus, and probably Meloidogyne spp. The application of this nematocidal effect of Tagetes

is discussed in terms of nurseries, ornamental gardens and orchards exhibiting "replant problems".

Nematode control -- Heat Therapy

387. BIRCHFIELD, WRAY and H. M. van PELT. Thermotherapy for nemas of ornamental plants. (Abstr.) Phytopathology 48: 341. 1958.

388. BIRCHFIELD, W. and H. M. van PELT. Thermotherapy for nematodes of ornamental plants. Plant Disease Reptr. 42: 451-455. 1958.
The tolerance of 24 ornamental plants to 10 minutes exposure at 50° C (a bare-root treatment) is recorded, as well as the degree of control of Meloidogyne incognita infesting the roots of these plants.

389. BRANDE, J.VAN DEN and A. GILLARD. Control of root nematodes by electric soil heating. (Flemish) Tuinbouwber 21: 63-64. 1957. (Hort. Abstr. 28: 384. 1958.)
Soil heating by electricity has given cheaper nematode control in greenhouses than steaming. When wire netting at a depth of 10-17 cm had raised the temperature of the top soil to 55-60° C nematodes were killed.

390. MAI, W. F. Effectiveness of di-electric heat in killing encysted golden nematode larvae. Plant Disease Reptr. 42: 449-450. 1958.
Di-electric heat treatments of burlap bags containing potato-root eelworm (Heterodera rostochiensis) cysts showed that temperatures reaching 205° to 230° F killed nematode larvae. The cost of equipment required to generate the heat makes the process impractical.

391. PÄÄSUKE, M. Jordgubbsnematoden och dess bekämpning. (Strawberry nematode and its control.) Fruktodlaren, 29: 45-48. 1958. (Hort. Abstr. 28: 384. 1958)
After hot water treatment survival of the strawberry variety NorthWest was about 50 percent, Konigin Louise 50-60 percent, and Macherauchs Fruhernte 60-70 percent.

Nematode control -- Nematocides -- Application and Mechanism of Action

392. BENEDICT, S. H. Fertilizer-nematocide mixtures can be profitable. Agr. Chem. 13 (9): 25-26. 1958.
Economic advantage of applications of fertilizer-nematocide mixtures are discussed.

393. BESEMER, A. F. H. and M. OOSTENBRINK. Comparison of some soil-disinfectants with nematocidal properties. (Flemish) Ghent. Landbhogesch. Meded. 22: 387-398. 1957. (Bibl. Agr. 22(6): 18. 1958.)

394. BISHOP, DAPHNE. A technique for screening antibiotics against eelworms. Nematologica 3: 143-148. 1958. (Helminth. Abstr. 27: 48. 1958)
The influence of a number of antibiotics on the ability of the root-nematode to invade and develop in tomato roots was studied. Experiments failed to give any evidence that the antibiotic tested affected the nematodes.

395. BROWN, A. L., J. J. JURINAK and P. E. MARTIN. Relation of soil properties to Br uptake by plants following soil fumigation with ethylene dibromide. Soil Sci. 86: 136-139. 1958.
Tomato and tobacco plants had marked increases in Br content as a consequence of soil fumigation. Clay content of soil had a highly significant effect on uptake of Br by plants, there being an increase in Br with increasing clay.

396. CHRISTIE, J. R. and V. G. PERRY. A low-phytotoxic nematocide of the organic phosphate group. Plant Disease Reptr. 42: 74-75. 1958.
Dichlorophenyl-diethyl-phosphorothioate was found to control populations

of plant-parasitic nematodes when applied to soil as a drench. The chemical was found to have pronounced residual properties and to have little phytotoxic activity. This chemical also has the additional advantage of controlling some soil inhabiting insects.

397. DONA DALLE ROSE, A. (Mechanization of nematocide treatment of sugar beets.) (In Italian.) Macch. & Motori Agr. 16 (2): 67-76. 1958. (Bibl. Agr. 22 (8): 141. 1958.)

398. GERTLER, S. I., JULIUS FELDMESSER and R. V. REBOIS. Screening tests on bromoacetates as nematocides. J. Agr. Food Chem. 6: 843-844. 1958.

Many of the 53 bromoacetates synthesized and tested as nematocides against Rhabditis sp. and Panagrellus sp. were found to exhibit high activity. About two-thirds of the esters gave an LD 95 of less than 20 ppm and about one half less than 10 ppm. The effect of the structural variation in the alcohol position of the ester is discussed. Several of the compounds show sufficient promise to warrant further testing.

399. HOLLIS, J. P. and MAX J. FIELDING. Population behavior of plant parasitic nematodes in soil fumigation experiments. Louisiana St. Univ. Agr. Exp. Sta. Bull. 515. 30 pp. 1958.

The occurrence and activities of common plant parasitic nematodes on important crop plants in Louisiana were investigated in 21 soil fumigation experiments in 1955-56. The results of this paper emphasize the generic differences in population trends and reactions to fumigants. The relationship between fumigant vapor-pressure and population recovery of nematodes following fumigation is also discussed.

400. HOLLIS, JOHN P. Specifications for ideal nematocides. Plant Disease Reptr. 42: 291-307. 1958.

An attempt has been made by Hollis to collect all the available knowledge about a restricted area in Louisiana, relevant to the problem of nematicide application. Empirical facts based on field experiments have been collected and placed on a rational basis. With this information at his disposal Hollis attempts to specify the physical properties of the ideal nematicide. Vapor pressure, activity, water solubility, phytotoxicity, mammalian toxicity, residual effects, stability, and chemical life in the soil are considered.

401. JURINAK, J. J. and D. H. VOLMAN. Thermodynamics of ethylene dibromide vapor adsorption of Ca-montmorillonite and Ca-kaolinite. Soil Sci. 86: 6-12. 1958.

The adsorption of E.D.B. was studied in high vacuum system and a technique is described for measuring pressures as low as $2 \times 10^{-2}$ mm with little uncertainty. The differential free energy, enthalpy, and entropy of adsorption was calculated at various surface concentrations from isotherm data obtained, at 28.0° and 15.6°C. These data indicate that, in the region of multi-layer adsorption, the adsorbate assumes liquid-like properties in both montmorillonite and kaolinite systems. In both systems, multi-layer formation was initiated before $\theta = 1$. In the kaolinite system the thermodynamic functions suggest that the adsorptive forces for E.D.B. vapor are less energetic but more homogeneous over a large $\theta$ range when compared with the montmorillonite system.

402. KENAGA, EUGENE E. Calibration of thermal conductivity units for use with commodity fumigants. Down to Earth 14: 6-7, 16. 1958.

Information is given for the calibration of the Gow-Mac Gasmaster on the Fumiscope with various concentrations of methyl bromide, carbon tetrachloride, and other gases. The information is especially useful to those who work with field and laboratory units where it is difficult to calibrate the units without special gas-handling equipment.

403. LOOS, C. A. Certain fatty acids and hexadecylamine as nematocides. Plant Disease

Reptr. 42: 1179-1186. 1958.

Fatty acids (heptanoic-undecylenic) are nematocidal within the range of 25 to 1000 ppm when applied in aqueous emulsion to surface, as judged by laboratory contact tests. However, they lose their effectiveness by passage through soil, and are no longer active nematocidal agents. They may have exceptional value as disinfectants of farm machinery, containers, etc.

404. LOOS, C. A. and G. J. STESSEL. A comparison of two contact nematocide test methods. Plant Disease Reptr. 42: 1187-1191. 1958.

Two contact test methods of screening chemicals for nematocidal activity were studied. A method utilizing an aeration-agitation apparatus is described and is compared with the method developed by A. C. Tarjan and P. C. Cheo. The merits and disadvantage of each method are discussed from the standpoint of time and labor, testing of nematodes in various stages of the life cycle, and variability of the results within and between both methods.

405. MARTIN, J. P. and P. F. PRATT. Fumigant, fungicides and the soil. J. Agr. Food Chem. 6: 345-348. 1958.

406. MILLER, P. M. and E. M. STODDARD. Increasing the hatching of eggs of cyst and rootknot nematodes with nabam. Science 128: 1429-1430. 1958.

Nabam in water solution retards hatching of Meloidogyne eggs. In soil nabam increases egg hatching of Meloidogyne and Heterodera tabacum, indicating that a decomposition product in soil is a hatching factor. Because of this attribute, combining nabam with a nematocide increases control of Meloidogyne by exposing more larvae to the nematocide while it is at maximum efficiency.

407. PARRIS, G. K. Soil fumigants and their use: a summary. Plant Disease Reptr. 42: 273-278. 1958. (Helminth. Abstr. 27: 54. 1958.)

A revision of a previous publication dealing with recent developments in soil fumigation. The nature and action of the various fumigants, chloropicrin, D-D, ethylene dibromide, methyl dibromide, Nemagon, Vapam, V-C 13 Nemacide, Terraclor, Mylone, and Telone, are discussed individually. A final section indicates changes in concept of soil fumigation during the last 5 years. In regard to the control of Actinomycetes in the soil, Terraclor, whose active ingredient is pentachloronitrobenzene (PCNB) is said to be very effective against Streptomyces (Page 277 of the review).

408. SHER, S. A., IVAN J. THOMASON, and R. R. McCASLIN. Chisel application of methyl bromide for root-knot nematode control. Plant Disease Reptr. 42: 288-290. 1958.

Injections of methyl bromide at 150 and 200 lb./acre with a chisel applicator gave good control of Meloidogyne incognita and increased the yield of sweet basil. Similar results were obtained when the fumigant was confined in the soil either with a tarp, or by rolling and sprinkling.

409. TURLIGINA, E. S. (Effect of certain chemicals on the reproduction of saprobiotic nematodes (Rhabditella sp.).) (Russian: English summary.). Zoologicheski Zhurnal 36: 1145-1149. 1957. (Helminth. Abstr. 26: 312 b. 1958)

A number of chemicals were shown in laboratory tests to inhibit the reproduction of a saprophytic species of Rhabditella by decreasing fertility and prolonging ontogenesis. They may be divided into those that are very toxic and can only be used on ornamental plants, i.e. systox, pyrophos, and octomethyl, and those that are not strongly toxic and can be used on vegetables, i.e. sodium salicylate, potassium rhodanate, and ammonium selitre.

410. VIEL, G. and J. GIBAN. (The retention of dibromoethane in soils.) Phytiatrie-Phytopharm. 7: 61-66. 1958. (Chem. Abstr. 52: 20858. 1958.)

The authors report that dibromoethane is retained several weeks in soil. After 8-9 weeks with soil temperatures below 15° C approximately 1 mg of

dibromoethane remains per gram of soil. The level at which the material is still effective but not phytotoxic is also given.

411. WARREN, G. F. Growers solve fumigation equipment problem in Indiana. Down to Earth 13 (4): 12. 1958. (Hort. Abstr. 28: 429. 1958)
A description is given of a 2-row soil fumigation unit, which can be used 7-10 days before transplanting melons.

412. YOUNG, V. H., Jr. Activity of V-C 13 Nemacide, a nonfumigant type nematocide. Agr. Chem. 13 (2): 30-31. 1958.
Nematocide V-C 13, lacking the physical property of a high vapor pressure, is uniquely different from most of the other nematocides. Because of low volatility it has good chemical stability and residual action on a number of nematode genera. Some disadvantages stemming from this low vapor pressure are the need of mechanical mixing or watering into soil, a slow killing action, and a failure to give adequate control of cyst nematodes. A decided advantage is its low phytotoxicity to a wide number of crop plants.

413. FUMIGATORE DEL TERRENO DI PRATICA REALIZZAZIONE. (A soil fumigator of practical design.) Inf. fitopat. 8: 141. 1958. (Hort. Abstr. 28: 527. 1958.)
The description for the design of a practical soil fumigator is given in detail.

Nematode control -- Nematocides -- Crops
See also 555

414. BAINES, R. C., T. A. DeWOLFE, and R. H. SMALL. Control of the citrus nematode, Phytophthora spp. and weeds by Mylone 85W when applied by different methods. Plant Disease Reptr. 42: 876-880. 1958.
The effectiveness of Mylone 85W for control of the citrus nematode, Phytophthora spp., and a number of weeds, when applied with different amounts of water, was determined in microplots on a sandy loam soil. Mylone 85W applied at the rate of 400 pounds active ingredient per acre in 6 and 8 acre-inches of water killed the citrus nematode in the top 4 feet of soil, and Phytophthora spp. in the surface 3 feet of soil. Mylone showed good stability in moist soil and moved downward when water was applied at periods up to 72 hours.

415. BAINES, R. C. et al. Nematode control on bearing trees. Calif. Citrogr. 43: 328-329. 1958. (Hort. Abstr. 28: 640. 1958)
Dibromochloropropane, applied around lemon and tangerine trees, has effectively controlled citrus nematode (Tylenchulus semipenetrans) and increased yields of lemons and tangerines. Control was most effective on sandy soils and was moderately good on two silt loam soils. Applications by chisel 8-9 inches deep was most satisfactory. Lack of response in two orange orchards may have been due to lack of vigour.

416. BÖHM, OTTO. Beitrag zur Kenntnis einer durch Nematoden hervorgerufenen Krankheit der Sellerie. (A nematode-induced disease of celery.) Pflanzenschutzber. 16 (1/3): 1-20. 1956. (Biol. Abstr. 32: 1779, entry 21162. 1958.)
The application of DD in large quantities, soil fumigation, and regular rotation of crops is effective in control of soil sickness. In the field only the last method is economic.

417. BRANDE, J. VAN DEN, J. D'. HERDE, and R. H. KIPS. Distribution of dichloropropane-dichloropropene in different kinds of soil. (Flemish.) Ghent. Landbhogesch. Meded. 22: 377-386. 1957. (Bibl. Agric. 22 (6): entry 49716. 1958.)
The control of potato root eelworm, Heterodera rostochiensis, in different soil types with the fumigant D-D is discussed.

418. CHRISTIE, J. R. and A. L. TAYLOR. Controlling nematodes in the home garden. U.S.

D.A. Farmers' Bull. 2048, 10 pp.. 1958.

419. CLAYTON, C. N. Peaches after peaches. Research & Farming 27: 12. 1958.
Peach trees were successfully replanted in root-knot-nematode-infested soils after soil fumigation with D-D and ethylene dibromide.

420. COLBRAN, R. C. Nematode control in pumpkins. Queensland Agr. Jour. 83: 499-501. 1957. (Biol. Abstr. 32: 1779, entry 21163. 1958.)
Soil fumigation with EDB by injection into the soil was found to give suitable control of three root-knot nematode species attacking pumpkins.

421. De HAAN, I. and G. A. DeZOETEN. Control of eelworm in orchards extremely difficult. Farming So. Africa 34 (8) 36-38. 1958.

422. ENDO, B. Y. and J. N. SASSER. Soil fumigation experiments for the control of the soybean cyst nematode, Heterodera glycines. Phytopathology 48: 571-574. 1958.
Soil fumigants were evaluated for control of the soybean cyst nematode (D-D, Telone, Nemagon, and methyl bromide). Plant growth, root nodulation, soybean yields were all increased as a result of the nematocide treatment. Although nematode populations were reduced by fumigation, these population differences were no longer significant at harvest time, indicating a rapid increase of nematode populations during the growing season.

423. FARRAR, LUTHER L. Oat yields as affected by chemical treatment of nematode infested soil. Down to Earth 14: 15-16. 1958.
The author studied the response of oat yields following application of various nematocides to soil known to be nematode-infested. Using moderate to high dosage rates, he found definite responses to fumigation and differences between fumigants. There were few significant differences between rates of application.

424. FOSTER, H. H. and D. FRED COHOON. Post-plant fumigation for the control of peach root-knot in South Carolina. (Abstr.) Phytopathology 48: 342. 1958.
Soil fumigation experiments were conducted, using liquid and granular Nemagon around root-knot-infested peach trees. The liquid form at the rate of 8 gal. of active ingredient per acre gave root-knot control, and was more effective than the granular Nemagon. Recent data would indicate that Nemagon may be effective for at least 2 years after fumigation.

425. GOFFART, H. and A. HEILING. Nebenwirkungen bei der Nematodenbekämpfung mit Shell D-D und verwandten Mitteln. Nematologica 3: 213-228. 1958.
The authors investigated a secondary growth-stimulating effect of D-D on sugar beets, over and above its nematocidal action. Sugar beets were grown on fumigated and nonfumigated plots known to be free of nematode species injurious to sugar beets. The authors observed the difference between beets grown on these plots for water content and surface area of leaves, osmotic pressure of the sap, ash content, and other qualitative differences. They concluded that since these differences in the plant and soil correspond to specific function of the Cl-ion, it is probable that the secondary action of this nematocide is due to its chlorine content.

426. GOOD, J. M. and A. E. STEELE. Control of sting nematodes for two growing seasons by soil fumigation. Plant Disease Reptr. 42: 1364-1367. 1958.
Of the nematocides tested for the control of sting nematodes infesting cotton- and corn-growing soils in Georgia, only dibromochloropropane gave significant control for two crop seasons.

427. GOOD, J. M. and A. E. STEELE. Soil fumigation for controlling root-knot nematodes on tomatoes for transplanting and for fresh fruit production. Plant Disease Reptr. 42: 1173-1177. 1958.
Soil fumigation with certain chemicals to control root-knot nematodes

on tomatoes did not give sufficient control to satisfy requirements for certification of tomato transplants as being root-knot-free. These materials, however, did give economic control in fields grown for fruit production.

428. GRAINGER, J. The field control of potato root eelworm. Scottish Agr. 37: 223-224. 1958. (Biol. Abstr. 32: 3504, entry 42138. 1958.)

The author offers advice on how to prevent a build-up of population or spread of potato root eelworm. The use of D-D for the control of eelworm in first early crops, and of fine-particle mercury dusts is briefly mentioned.

429. HALLER, H. L. Soil fumigation, a new and expanding market. Agr. Chem. 13 (11): 33, 108-109. 1958.

A general discussion of the growth in the use of nematocides. Reference is made to the fumigants used in the past. The extent to which new and old fumigants are being used currently in control of nematode plant diseases, and the possible future market for nematocides are discussed.

430. JENKINS, W. R. Wipe out nematodes. Plant, fumigate, and fertilize all at one time with new nematicide. Am. Veg. Grower & Mkt. Growers J. 6 (5): 30. 1958.

431. KANTZES, J. G., O. D. MORGAN and W. R. JENKINS. The possible use of 1,2-dibromo-3-dichloropropane ("Nemagon" and "Fumazone") on vegetable crops. Md. Agr. Exp. Sta. Misc. Article 314: 2 pp. 1958.

This fumigant offers promise in the control of root-knot nematode on various crops. The granular form can be mixed with fertilizer and applied to soil containing seed or living plants of certain kinds of crops.

432. KELSHEIMER, E. G. Control of nematodes in gladiolus corms. Gladiolus Mag. 22: 13-15. 1958. Proc. Florida State Hort. Soc. 68: 348-350. 1955. (Chem. Abst. 52: 20847. 1958.)

The most effective treatment found by the author in controlling nematodes on gladiolus corms was a parathion emulsion containing 4 lbs. parathion/gal. at the rate of 1 pt. to 100 gallons. Details of methods of application and safety precautions in using the dip are also given.

433. KELSHEIMER, E. G. and A. J. OVERMAN. Nematodes affecting Florida chrysanthemums and their control. Proc. Florida State Hort. Soc. 70 (1957): 350-352. 1958. (Hort. Abstr. 28: 455, entry 2879. 1958.)

The methods and materials used in controlling soil-inhabiting nematodes on chrysanthemum are given.

434. KUIPER, K. and E. DRIJFHOUT. Bestrijding van het wortelaaltje Hoplolaimus uniformis Thorne 1949 bij de teelt van peen. (Control of root nematode in carrot growing.) (In Flemish.) Meded. Landbhogesch. Ghent. 22: 419-426. 1957. (Hort. Abstr. 28: 592. 1958.)

Soil fumigation with D-D and with formalin appeared to give 90 percent control of Hoplolaimus uniformis and improve carrot growth.

435. LANGE, A. H. and O. V. HOLTZMANN. Papaya responds to soil fumigation. Hawaii Fm. Sci. 6: 6-7. 1958. (Hort. Abstr. 28: 653. 1958.)

Several nematocides have improved papaw growth and/or yields in greenhouse and field experiments. Where nematodes (Rotylenchulus reniformis) are the primary cause of poor growth, applications of Nemagon, D-D, or EDB are recommended. In other conditions methyl bromide may be effective.

436. LANGE, A. H. Response of papaya to soil fumigation. Down to Earth 14 (1): 4-5. 1958. (Hort. Abstr. 28: 653-654. 1958.)

The author reports increased growth and/or yields of papaya from trees planted on soil treated with fumigants for nematode control. In some of the trials significant increases in growth were not followed by increases in yield, which suggests that factors other than nematode control may be involved.

437. LEAR, BERT and D. J. RASKI. Control by soil fumigation of root-knot nematodes affecting sugar beet production in California. Plant Disease Reptr. 42: 861-864. 1958.

Broadcast application of D-D, EDB, Telone, and Nemagon resulted in good root-knot nematode control and increased sugar beet yields. Telone appeared more effective than an equal volume of D-D. In row treatments one plot indicated that 8 gal. per acre was necessary for the minimum economic control of root-knot. Row treatment with Nemagon and Telone was less effective than the broadcast method.

438. LEWIS, G. D. and W. F. MAI. Chemical control of Ditylenchus dipsaci (Kühn) Filipjev in organic soils of southern New York. Plant Disease Reptr. 42: 1360-1363. 1958.

Organic soils used for onion culture in southern New York and infested with Ditylenchus dipsaci (Kühn) Filipjev were fumigated with D-D at rates of 50 or more gallons per acre. All treatments resulted in excellent control. No infested onions have been found in the fields for 2 years. No injury resulted in onion crops following fumigation even with a total rate of 110 gallons of D-D per acre.

439. LORDELLO, L. G. E. Experimentos com os nematicidas D.D., E.D.B. e brometo de metilo no combate aos nematódeos causadores de galhas em raízes de plantas (Meloidogyne spp.) (Experiments with D-D, EDB, and methyl bromide for control of nematodes (Meloidogyne spp.) in the roots of plants.) An. Esc. Sup. Agr. Queiroz. 12/13: 167-177. 1955/1956. (Hort. Abstr. 28: 425, entry 2707. 1958.)

Neither D-D, ethylene dibromide, nor methyl bromide at standard rates gave complete control of nematodes in tomato root galls after 5-30 days of rotting in soil, but, unless thick woody roots are present, soil fumigation with any of the substances should be economic for practical purposes.

440. LOWNSBERY, B. F. and S. A. SHER. Root-lesion nematode on walnut. Calif. Agr. 12 (5): 7, 12. 1958. (Hort. Abstr. 28: 384. 1958.)

Pre-plant fumigation with Shell D-D, Dowfume W85, or Shell Nemagon improved the initial growth of black walnut seedlings. Populations of root-lesion nematodes increased rapidly after fumigation, but growth improvements were maintained by annual soil injections of Nemagon.

441. MILLER, P. M. Fumigation when transplanting nursery stock. Plant Disease Reptr. 42: 1178. 1958.

The advantages are stated, and methods given for the use of nematocides when nursery stock is being transplanted.

442. MILLER, P. M. and G. S. TAYLOR. Superior control of tobacco stunt nematodes with a nematocide mixture. (Abstr.) Phytopathology 48: 264. 1958.

Dorlone (a mixture containing 19 percent ethylene dibromide and 75 percent 1,3-dichloropropene) gave better control of tobacco stunt nematode than either of the materials separately. The authors concluded that a combination of nematocides improved the control of mixed nematode populations.

443. MORGAN, O. D. Observations on fumigation of tobacco soils. Plant Disease Reptr. 42: 316-317. 1958.

Observations were made over a 3-year period on the control of root-knot nematode by D-D, EDB, and Nemagon fumigants. The dosage rates of the three nematocides which were found to give some nematode control are given; none of these rates has a phytotoxic effect on tobacco. The incidence of Fusarium wilt was also reduced.

444. O'BANNON, J. H. Application of emulsifiable dibromochloropropane in irrigation water as a preplanting soil treatment. Plant Disease Reptr. 42: 857-860. 1958.

An emulsifiable concentrate of DBCP was applied as a preplanting treatment in irrigation water to nematode-infested sandy loam soil. A

constant metering device on the centrifuge pumps discharged DBCP into the irrigation water, resulting in a reasonably uniform distribution and penetration of the material in rows 1250 ft. long and to a depth of at least 12 inches.

445. PERSING, C. O. Sodium N-methyldithiocarbamate in control of pests affecting tobacco. Congr. sci. intern. tabac, Prem. congr., Paris-Bergerac, 2: 669-673. 1955. (Chem. Abstr. 52: 20839. 1958.)

This dithiocarbamate was effective in soil treatments against the following species of nematodes: Tylenchorhynchus claytoni, Xiphinema americanum, Meloidogyne sp., Pratylenchus sp., Helicotylenchus sp. The material was also effective against a number of other fungus pathogens of tobacco as well as some insect pests.

446. PONTORIERO, P. L. Soil fumigation for outdoor vegetable growers. Ohio Veg. & Potato Growers Assoc. Ann. Proc. 42: 68-72. 1957.

The control of nematode diseases of plants by soil fumigants is discussed.

447. PUCCI, E. Le anguillulosi. (Nematode infestations.) Inf. fitopat. 8: 50-57, 71-77. 1958. (Hort. Abstr. 28: 465. 1958.)

Nematode diseases of narcissi, chrysanthemums, primulas, strawberries, citrus and other crops are discussed. Some consideration is also given to the control of these nematode diseases.

448. RASKI, D. J. and B. LEAR. Control of sugar-beet nematode. Calif. Agr. 12 (5): 8, 12. 1958. (Helminth. Abstr. 27: 18. 1958.)

Results of field tests with D-D and Nemagon and preliminary tests with Vapam indicate that chemical control of Heterodera schachtii on sugar-beet in California, where this crop is usually grown on clay loams or clays, is not an economic proposition.

449. RENNINGER, GEORGE, JOHN COFFEY, and BORIS SOKOLOFF. Effect of hydrogenated fish oils on citrus-tree destroying nematodes. Plant Disease Reptr. 42: 1057-1065. 1958.

A water-soluble hydrogenated fish oil preparation, FOAH, was tested for its ability to control the burrowing nematode (Radopholus similis), which causes spreading decline of citrus trees. The material is sprayed on the soil surface. The theory is suggested that hydrogenated fish oil interfered with respiration and oxidation processes in the nematodes, thus suffocating them.

450. REYNOLDS, HAROLD W. and JOHN H. O'BANNON. The citrus nematode and its control on living citrus in Arizona. Plant Disease Reptr. 42: 1288-1292. 1958.

The nematocide DBCP metered into irrigation water was effective in controlling the citrus nematode, Tylenchulus semipenetrans, in Arizona citrus groves.

451. REYNOLDS, HAROLD W. Control of the cotton root-knot nematode on extra-long-staple cotton. Plant Disease Reptr. 42: 944-947. 1958.

The results of field-scale fumigation experiments on the control of root-knot nematode in cotton soils are reported.

452. RITTER, M. (Chloropicrin in the fight against root eelworms (Meloidogyne incognita) in truck gardens.) Phytiatrie-Phytopharm. 7: 73-80. 1958. (Chem. Abstr. 52: 28043. 1958.)

Chloropicrin and D-D were compared for their efficacy in controlling root-knot nematodes in different soil types, using two methods of sealing the soil surface. The chloropicrin-treated soils had the greatest increase in tomato production.

453. RUI, D. and G. GIRALDI. Nematodi fitoparassiti e nematocidi. (Plant-parasitic nema-

todes and nematocides.) (English summary.) Ann. Sper. agrar. 12: 481-502. 1958. (Hort. Abstr. 28: 582. 1958.)

Cymag (a sodium cyanide product), D-D, and ethylene dibromide are discussed as to their ability for controlling root-knot nematode.

454. RUSSO, G. New synthetic organic antiparasitical products (insecticides, acaricides, nematocides) Naples U. Facol. Sci. Agr. Ann. (ser. 3) 22: 209-216. 1956/57. (Bibl. Agr. 22: entry 81296. 1958.) (not reviewed.)

455. SLEETH, B. Soil fumigation increases growth of citrus replants. J. Rio Grande Valley hort. Inst. 12: 53-56. 1958. (Hort. Abstr. 28: 640. 1958.)

Increased growth of sour orange seedlings in screenhouse experiments was noted after soil fumigation with D-D. In field trials fumigation with EDB at 350 lb./acre increased the size of grapefruit and orange trees by an average of 20 percent over the first 5 years. Soil treatment with N, P, S, and minor elements failed to have any stimulatory effect on seedling growth.

456. STEELE, ARNOLD E. and J. M. GOOD. Evaluation of several nematocides for control of sting nematodes on lima beans. Plant Disease Reptr. 42: 1284-1287. 1958.

Five nematocides were evaluated by field plot tests for ability to control sting nematodes on lima beans.

457. TARJAN, A. C. Spray materials for decontaminating nematode-infested grove equipment. Proc. Fla. St. hort. Soc. 70 (1957): 85-90. 1958. (Hort. Abstr. 28: 480. 1958.)

One percent caprylic acid, 2.6 percent sodium hypochlorite in water was used in freeing equipment of Radopholus similis.

458. THOMAS, P. R., P. WIGGELL and W. J. MOYSE. Observations on eelworm control in narcissus in the Isles of Scilly. Plant Path. 7: 49-50. 1958. (Hort. Abstr. 28: 628. 1958.)

Two plots seriously affected by Ditylenchus dipsaci were each treated with EDB and with D-D at 100 or 200 gal./acre. No eelworm-infested plants were found in the first year after treatment; in the second year re-infestation had started, being more severe in the EDB treated plots than after D-D treatment.

459. TODD, F. A. and C. J. NUSBAUM. You can avoid fumigant injury. Res. & Farming, N. C. Agr. Expt. Sta. 16 (3): 3. 1958.

Three rules of advice are suggested for the avoidance of fumigation damage in growing flue-cured tobacco.

460. TURLIGINA, E. S. A new method of gall nematode control. Priroda 47: 95-96. 1958. (Chem. Abstr. 52: 15817. 1958.)

A single watering of cucumber plants infested by root-knot nematodes with 0.25 percent potassium thiocyanate or sodium salicylate and 1 percent $NH_4NO_3$ solution is effective against nematodes, and substantially reduces the fertility of females.

461. WILSKI, A. (Investigations on the control of sugar-beet nematode (Heterodera schachtii Schmidt) with chemicals.) (In Polish.) Rocz. Nauk. Roln. Ser. A, Roślinna. 75: 645-666. 1957. (Bibl. Agr. 22: entry 49737. 1958.) (not reviewed)

462. WINSLOW, R. D. Eelworm control. Gt. Brit. Min. Agr. Fisheries & Food Agr. 65: 66-69. 1958. (Bibl. Agr. 22: entry 68341. 1958.) (not reviewed.)

463. WINSTEAD, N. N., J. C. WELLS and J. N. SASSER. Root-knot control in vegetable crops using D-D and EDB with and without vermiculite as a carrier. Plant Disease Reptr. 42: 180-183. 1958.

EDB and D-D were applied to the soil as liquids or on vermiculite as a carrier. Experiments showed that effective control of root-knot was obtained irrespective of method of application.

464. FOR SOIL FUMIGATION. World Crops 9: 507-508. 1957. (Helminth. Abstr. 26: 473. 1958.)

Efficacy of Nemagon (1,2-dibromo-3-chloropropane) as a nematicide.

NEMATODES
See also 122

465. BAINES, R. C. et al. A difference in the pathogenicity of the citrus nematode from trifoliate orange and sweet orange roots. (Abstr.) Phytopathology 48: 391. 1958.
Citrus nematodes obtained from Poncirus trifoliata infested 90 percent of P. trifoliata seedlings severely whereas citrus nematode obtained from sweet orange roots slightly infested 1 percent of P. trifoliata seedlings, leaving 99 percent uninfested.

466. BIRD, ALAN F. The adult female cuticle and egg sac of the genus Meloidogyne Goeldi, 1887. Nematologica 3: 205-212. 1958.
Both the chemical composition and structure of the adult female cuticle and egg sac of Meloidogyne hapla and M. javanica were studied. Sections showed that the cuticle consists of a thin, darkly staining surface layer covering a homogenous substance which is divided into three layers by two darkly staining bands of material. The egg sac is a tanned glycoprotein whereas the adult female cuticle consists of a thin tanned lipoprotein covering a thicker less resistant homogenous layer.

467. BRAUN, A. J. Plant-parasitic nematodes found in association with strawberry roots in the United States. Plant Disease Reptr. 42: 76-83. 1958.
In the northern states Pratylenchus is the predominant parasitic nematode in strawberry whereas Xiphinema, Tylenchorhynchus, and Helicotylenchus predominate in the southern states. Root-knot nematode was most prevalent in the north-central region.

468. BROWN, E. B. Observations on a race of Ditylenchus dipsaci attacking annual aster and sweet sultan. Plant Path. 7: 150-151. 1958.
The first record of damage by D. dipsaci to these plants in England. The race of eelworm also attacked oats, onions, annual phlox, field beans, sugar beet (slightly), and asters. Carrots were not attacked.

469. BROWN, E. B. Pea root eelworm in the eastern counties of England. Nematologica 3: 257-268. 1958.
It is suggested that the pea plant is very susceptible to Heterodera gottingiana and, therefore, even occasional plantings of pea or field bean maintain sufficient populations of the eelworm to result in failure of a pea crop.

470. CARROLL, K. K. Purification and properties of eelworm hatching factors. Hatching factors for the cabbage, hop and beet root eelworms (Heterodera cruciferae, H. humuli, and H. schachtii respectively). Nematologica 3: 197-204. 1958.
Root leachings from black mustard, hop and sugar beets were used as sources of the hatching factors of cabbage, hop and beet eelworms respectively while the mustard leachings also furnished a hatching factor for beet eelworm. The experiments included studies on the bioassay of the hatching factors as well as some of their properties.

471. CAVENESS, FIELDS E. Two new geographic locations for the sugar beet nematode, Heterodera schachtii. Plant Disease Reptr. 42: 280. 1958.
Imperial County, California, and Butte County, South Dakota.

472. CHAPMAN, R. A. The effect of root-lesion nematodes on the growth of red clover and alfalfa under greenhouse conditions. Phytopathology 48: 525-530. 1958.
The growth of red clover and alfalfa in soil infested with a root-lesion nematode population made up primarily of Pratylenchus penetrans and P. coffeae with some P. minyus was significantly less than that of control plants.

473. CHRISTIE, J. R. and WRAY BIRCHFIELD. Scribner's lesion nematode, a destructive parasite of amaryllis. Plant Disease Reptr. 42: 873-875. 1958.
Stunting of amaryllis associated with root infection by Pratylenchus scribneri. Symptoms on amaryllis are described as well as on other hosts

occurring in Florida.

474. COLE, C. S. and H. W. HOWARD. Observations on giant cells in potato roots infected with Heterodera rostochiensis. J. Helminth. 32: 135-144. 1958.

This is a study of the early formation of giant cells in potato roots infected with H. rostochiensis. Giant cells may be formed by cells of the cortex, endodermis, pericycle, and parenchyma cells of the central vascular strand. The first giant cells appear to be formed in the cortex and pericycle. Giant cell formation by the parenchyma cells of the central vascular strand leads to no cambium and hence no secondary xylem formation, resulting in an irregular appearance of the central vascular strand. Giant cells have granular cytoplasm and some may be multinucleate.

475. COURSEN, B. W., R. A. ROHDE and W. R. JENKINS. Additions to the host lists of the nematodes Paratylenchus projectus and Trichodorus christiei. Plant Disease Reptr. 42: 456-460. 1958.

Of 101 plant species and varieties tested, 89 were found to be hosts of the pin nematode, Paratylenchus projectus. The known host range of the stubby root nematode, Trichodorus christiei, was extended with the addition of 66 more species and varieties.

476. COURSEN, B. W. and W. R. JENKINS. Host-parasite relationships of the pin nematode, Paratylenchus projectus, on tobacco and tall fescue. Plant Disease Reptr. 42: 865-872. 1958.

General effects on tobacco, using large numbers of P. projectus as inoculum, include stunting of top growth, shortened internodes, and marked root proliferation. Similar symptoms occurred on tall fescue in addition to increased tillering. There was no visible evidence of damage on the roots of either host.

477. COURSEN, B. W. and W. R. JENKINS. Host-parasite relationships of the pin nematode, Paratylenchus projectus, on tobacco and tall fescue. (Abstr.) Phytopathology 48: 460. 1958.

(See abstract #476.)

478. DICKERSON, O. J. and D. A. SLACK. Parasitic nematodes associated with strawberries in Arkansas. (Abstr.) Phytopathology 48: 342. 1958.

High populations of Pratylenchus coffeae were recovered consistently in association with black root rot of strawberry plants growing on relatively heavy soil. With the other nematodes isolated during the survey no relationship could be determined between number of nematodes recovered and plant vigor.

479. DROPKIN, V. H. et al. Effect of osmotic concentration on hatching of some plant parasitic nematodes. Nematologica 3: 115-126. 1958.

The authors demonstrated negative correlation between osmotic concentration of a solution and emergence of nematodes from eggs. The inhibition is reversible and the length of time necessary for recovery from inhibition varies directly as the original osmotic concentration. Nematodes tested include Heterodera rostochiensis, Meloidogyne arenaria, M. javanica, and Ditylenchus dipsaci. The results are discussed in terms of the possible role of this relationship in the ecology.

480. EDGERTON, L. J. and K. G. PARKER. Cold hardiness of Montmorency cherry affected by nematode damage. Farm Research 24(2): 12. 1958.

In cold hardiness studies with Montmorency cherry trees, twigs from trees in plots treated for nematode control were found to be more cold resistant during the dormant season than twigs from trees in untreated soil.

481. ELLENBY, C. Day length and cyst formation in the potato root eelworm, Heterodera rostochiensis Wollenweber. Nematologica 3: 81-90. 1958.

With two of the varieties of potato tested, the greater number of cysts on

the roots were produced when the plants were grown under a "long day" rather than a "short day". However this difference did not occur with a third potato variety, suggesting different physiologic reactions of the different varieties to the change in the photoperiod.

482. ELLENBY, C. and A. B. GILBERT. Influence of certain inorganic ions on the hatching of the potato root eelworm, Heterodera rostochiensis Wollenweber. Nature 182: 925-926. 1958.

The authors subjected cysts to a pre-treatment in solutions of sodium chloride, potassium chloride, calcium chloride, and magnesium chloride, with a further lot soaked in distilled water. Two weeks later the cysts were washed and stimulated with inorganic-free hatching factor. Emergence from cysts first soaked in the salt solutions was about three times as high as the control. The differences were greatest and most persistent with potassium chloride and sodium chloride.

483. ELLENBY, C. Root diffusates of Solanum tuberosum and Digitalis purpurea. Nature 181: 920-921. 1958.

It has been shown previously that potato root eelworm hatching factor possesses certain affinities with the cardiac glycosides. Since cardiac substances occur in foxglove, diffusates from these two plants were compared. It was found that diffusates from potato and foxglove have many of the same properties including cardiotonic activity, colorimetric assay, and peroxide activity after concentration in a Tower's evaporator.

484. EPPS, J. M. and A. Y. CHAMBERS. New host records for Heterodera glycines; including one host in the Labiatae. Plant Disease Reptr. 42: 194. 1958.

The new hosts reported include hemp sesbania (Sesbania macrocarpa), white lupine (Lupinus albus), and henbit deadnettle (Lamium amplexicaule). The last-named is a member of the Labiatae and is the first host reported outside the Leguminosae.

485. EPPS, JAMES M. Viability of air-dried Heterodera glycines cysts. Plant Disease Reptr. 42: 594-595. 1958.

No viable larvae of the soybean cyst nematode, Heterodera glycines Ichinohe, were found in cysts after 1-month storage period in seed bags.

486. FASSULIOTIS, GEORGE. Effects of ionizing radiations on the golden nematode, Heterodera rostochiensis. (Abstr.) Radiation Research 9: 112-113. 1958.

Cysts were irradiated with X-rays and with $\gamma$-rays with doses ranging from 5 to 1280 kr. A dose of 160 kr. or above delayed onset of hatching and reduced the emergence. No larvae hatched after 640 kr. Abnormal body measurements were apparent after 80 kr. Chromosome aberrations in the form of fragments and bridges at anaphase were found in maturing eggs recovered from females which developed from irradiated larvae.

487. FELDMESSER, JULIUS. Burrowing nematode population samplings as affected by a number of variables. (Abstr.) Phytopathology 48: 393. 1958.

Relative soil moisture has little or no influence on numbers of nematodes recovered whereas soil temperature is highly correlated negatively with the number of nematodes found. Correlation between numbers of nematodes within the roots and upon the roots was significant at the 1 percent level.

488. FERRIS, VIRGINIA R. and R. L. BERNARD. Plant parasitic nematodes associated with soybeans in Illinois. Plant Disease Reptr. 42: 798-801. 1958.

Mainly Pratylenchus, Helicotylenchus, Paratylenchus, and Tylenchorhynchus.

489. FERVER, A. F. and H. W. CRITTENDEN. Host-parasite relationships of Avena sativa and a root-knot nematode, Meloidogyne incognita acrita. Phytopathology 48: 461. 1958.

No differences in amino acids and sugars were noted between two resistant and two susceptible varieties. It was noted that the inner tangential endodermis cell wall is thicker in resistant varieties than in susceptible varieties.

490. FORD, H. W. and C. I. HANNON. The burrowing nematode, Radopholus similis, in roots of Crotalaria spectabilis. Plant Disease Reptr. 42: 461-463. 1958.

The burrowing nematode is the primary cause of spreading decline of citrus. Although Crotalaria spectabilis has been recommended as a non-host cover crop in the control program, the present studies indicate that R. similis is capable of penetrating roots of C. spectabilis and laying viable eggs therein, casting some doubt on the value of this recommendation.

491. GASKIN, TIMOTHY A. Weed hosts of Meloidogyne incognita in Indiana. Plant Disease Reptr. 42: 802-803. 1958.

Listing of common weed hosts of Meloidogyne incognita and M. incognita var. acrita in Indiana based on greenhouse tests.

492. GILL, D. L. Effect of root knot nematodes on Fusarium wilt of mimosa. Plant Disease Reptr. 42: 587-590. 1958.

More wilting occurred in soil infested with Fusarium oxysporum f. perniciosum and either Meloidogyne incognita or M. javanica in combination than in soil infested with Fusarium alone.

493. GOLDEN, A. MORGAN. Influence of leaf diffusate of sugar beet on emergence of larvae from cysts of the sugar-beet nematode (Heterodera schachtii). Plant Disease Reptr. 42: 188-193. 1958.

It is shown that larval emergence from cysts in leaf diffusate of sugar beet was more than twice as great as the emergence in plain tap water, but approximately half that from cysts in root diffusate of sugar beet.

494. GOOD, J. M. et al. Studies of Pratylenchus brachyurus on peanuts. Phytopathology 48: 530-535. 1958.

Root lesion nematodes were found in the roots, pegs, and mature shells of peanuts but were most numerous in the shells where they colonized in dark necrotic lesions. Infested shells remained a source of inoculum after being cured and stored over winter.

495. GOODEY, J. B. and D. J. HOOPER. Observations on the effects of Ditylenchus dipsaci and Anguina tritici on certain wheat and barley varieties. Nematologica 3: 24-29. 1958.

It appears that, with the oat race of D. dipsaci occurring in Britain, either wheat or barley may be grown safely. It was also found that barley is, for all practical purposes, not attacked by A. tritici.

496. GRAHAM, C. W. A nematode genus new to Europe. Plant Path. 7: 114. 1958.

Naccobus sp. on roots of tomato.

497. GRAHAM, T. W. Root knot and other nematodes in relation to the development of tobacco black shank. (Abstr.) Phytopathology 48: 343. 1958.

Mixture of Phytophthora parasitica var. nicotianae and Meloidogyne incognita var. acrita produced severe black shank on Dixie Bright 101. The fungus in combination with Pratylenchus brachyurus gave only traces of black shank as was also the case with Rotylenchus brachyurus. The fungus in combination with Tylenchorhynchus claytoni developed slight to moderate black shank. Root damage by the nematode did not appear to be correlated with the degree of black shank.

498. HAGUE, N. G. and J. J. HESLING. Population studies on cyst-forming nematodes of the genus Heterodera. Proc. Linnean Society of London 169: 86-92. 1958.

The rate of increase of Heterodera rostochiensis and H. major decreases the higher the initial population. Under given conditions a certain initial popu-

lation will produce the maximum final population. If the initial population is increased further the final population decreases. Relatively more large cysts are produced from low inocula, and the mean egg content of new cysts therefore appears to fall with increase of inoculum. From similar inocula of H. major relatively more large cysts are produced on barley than on oats.

499. HAHN, S. (Root gall eelworms as pests of lettuce and carrots grown out of doors.) (German.) NachrBl. dtsch. PflSchDienst Braunschweig 10: 123-126. 1958.
Meloidogyne hapla on lettuce and carrots.

500. HEALY, A. J. Eelworm (Anguina agrostis (Steinb.) Filipjev) in Agrostis tenuis Sibth. in New Zealand. New Zealand J. Agr. Res. 1: 265-266. 1958. (Helminth. Abstr. 27: 45. 1958.)
Galled flowers of Agrostis tenuis in New Zealand were attributed to attack by Anguina agrostis.

501. HENDERSON, V. E. Relationship between some clovers and Ditylenchus destructor Thorne, 1945. Nature 181: 59-60. 1958.
It was shown that certain legumes increased the population of D. destructor in their rhizospheres. Root necrosis, probably of fungal origin, was evident in most of these plants. It is suggested the nematodes' increase is correlated with their feeding on the fungi in the necrotic roots.

502. HESLING, J. J. The efficiency of certain grasses as hosts of cereal root eelworm. Plant Path. 7: 141-143. 1958.
The following grasses were tested as hosts of Heterodera major: Italian ryegrass, Lolium italicum, perennial ryegrass, Lolium perenne, cocksfoot, Dactylis glomerata, and timothy, Phleum pratense. Timothy is a very poor host whereas the other three grasses increased the population, but not nearly to the same extent as on oats grown with similar inocula under similar conditions.

503. HESLING, J. J. Heterodera major O. Schmidt, 1930 -- population changes in the field and in pots of fallow soil. Nematologica 3: 274-282. 1958.
Barley produced an increase (up to five times) in the number of larvae per gram of soil. Under Italian ryegrass and cocksfoot (both hosts of this eelworm) the population fell, as it did under fallow or a non-host crop, the reduction being about 60 percent.

504. HEWITT, W. B. et al. Nematode vector of soil-borne fanleaf virus of grapevines. Phytopathology 48: 586-595. 1958.
It is demonstrated that fanleaf disease of grapevines in California is soil-borne and transmitted by the nematode Xiphinema index. This is the first report showing a nematode vector of a plant virus.

505. HOLLIS, JOHN P. Relations between root knot and fusarium vascular discoloration in cotton varieties. Phytopathology 48: 661-665. 1958.
The data presented enable separate ratings of varietal reactions to root knot and vascular discoloration and a statement of the problem of racial determinations within root-knot nematode species.

506. HOPPER, B. E. Plant-parasitic nematodes in the soils of southern forest nurseries. Plant Disease Reptr. 42: 308-314. 1958.
Meloidodera and Tylenchorhynchus were the only plant parasitic nematode genera found to be directly associated with seedling injury in the 35 nurseries included in the survey.

507. HUNTER, A. H. Nutrient absorption and translocation of phosphorus as influenced by the root knot nematode (Meloidogyne incognita var. acrita). Soil Sci. 86: 245-250. 1958.
Under the conditions of this experiment, in which the root system was continually bathed by the nutrient solution, the observed detrimental effects of the

root-knot nematode Meloidogyne incognita var. acrita on growth of tomato plants cannot be attributed to an interference with the absorption or translocation of the mineral elements N, K, Ca, Mg, Fe, or Cu.

508. JENSEN, HAROLD J. et al. Potato-rot nematode, Ditylenchus destructor Thorne 1945, found in dahlia roots. Plant Disease Reptr. 42: 1357-1359. 1958.
Ditylenchus destructor was found on dahlia roots in Oregon. Diagnosis of infection is handicapped by lack of above-ground symptoms or characteristic root symptoms.

509. JOHNSTON, TITUS. The effect of soil moisture on Tylenchorhynchus martini and other nematodes. Proc. Louisiana Acad. Sciences 20: 52-55. 1958.
Optimum soil moisture levels for survival of T. martini ranged from 40 to 60 percent of field capacity. For other nematodes (not stated) in the same soil, the optimum moisture level for survival ranged from 75 to 100 percent of the field capacity.

510. KIRKPATRICK, J. D. and W. F. MAI. Pratylenchus penetrans; serious pest of fruit tree roots. Farm Research 24 (2): 11. 1958.
Affecting growth of cherry and apple.

511. KRUSBERG, L. R. and L. W. NIELSEN. Pathogenesis of root-knot nematodes to the Porto Rico variety of sweetpotato. Phytopathology 48: 30-39. 1958.
The influence of Meloidogyne incognita var. acrita on plant growth and histopathological changes in the root system were studied. Three major infection courts were evident, i.e. young root tips, lateral root ruptures, and the surfaces of cracks. After penetration the site of feeding of the larvae varied with the infection court. Larvae came to rest primarily in the stele in the region of cell elongation, in the cambial zone, or in the parenchyma, depending upon whether the infection court was young root tips, lateral root ruptures, or crack surfaces, respectively. Nematode feeding stimulated formation of giant cells, "abnormal xylem", hyperplastic parenchyma, and cork.

512. KRUSBERG, L. R. and HEDWIG HIRSCHMANN. A survey of plant parasitic nematodes in Peru. Plant Disease Reptr. 42: 599-608. 1958.
A survey of plant-parasitic nematodes in several agricultural areas of the coast, mountains, and selva of Peru was made during July and August of 1957. A total of 208 collections contained 33 plant parasitic nematode species representing 14 genera. Meloidogyne spp. were most important on the coast and in the selva, and Heterodera rostochiensis in the mountains.

513. LEACH, R. Blackhead toppling disease of bananas. Nature 181:204-205. 1958.
Disease is caused by Radopholus similis, the variety Locatan being particularly susceptible. The nematode may be found in purplish streak lesions on young roots and also at the junction of diseased and healthy tissue near the surface of the corm.

514. LESTER, E. and E. C. LARGE. Surveys of clover rot with incidental observations on eelworm in clover: England and Wales, 1953-1955. Plant Path. 7: 115-124. 1958.
The survey carried out in England and Wales during the years 1953 to 1955 was primarily for clover rot, but in the course of the work the presence of eelworm was recorded in about 20 percent of the fields with the eelworm causing moderate to severe loss in about 7 percent of the fields each year.

515. LEWIS, G. D. et al. Reproduction of various Meloidogyne species in onion. Plant Disease Reptr. 42: 447-448. 1958.
Onion roots were inoculated with Meloidogyne hapla, M. incognita, M. incognita acrita, M. javanica, M. arenaria and M. arenaria thamesi. All 6 species were able to cause knots on the roots. All 6 species were able to carry through 2 generations in onion roots, but the rate of reproduction in the case of M. arenaria thamesi was observed to be much lower than that of

the other 5 species.

516. LORDELLO, LUIZ GONZAGA E. and R. CESNIK. Alguns nematodeos do tomateiro. Rev. Brasil. Biol. 18: 159-165. 1958.
Roots of tomato plants collected in the State of São Paulo, Brazil, were attacked by Meloidogyne javanica and another species of Meloidogyne of the M. incognita group.

517. LORDELLO, LUIZ GONZAGA E. and A. P. L. ZAMITH. (Nematode parasites of soybean and cotton roots in the State of S. Paulo and its implication in crop rotation.) Revista de Agricultura 33: 161-166. 1958.
Pratylenchus steineri damaging cotton and soybean, with cotton suffering greater damage than soybean.

518. LORDELLO, LUIZ GONZAGA E. and A. P. L. ZAMITH. (Nematodeos atacando cafeerio no estado de São Paulo.) Revista de Agricultura 33: 59-62. 1958.
Meloidogyne exigua on coffee in Brazil. (See abstract #519.)

519. LORDELLO, L. G. E. and A. P. L. ZAMITH. A note on nematodes attacking coffee trees in Brazil. Plant Disease Reptr. 42: 199. 1958.
Meloidogyne exigua appears to be an important detriment to coffee production in certain regions.

520. LORDELLO, L. G. E. Parasitismo de Aphelenchus avenae em raizes de cantalupe (Nematoda, Aphelenchidae). Revista Brasileira de Biologia 18: 33-36. 1958.
The author found an adult female and eggs of A. avenae in the roots of cantaloupe and concludes that this nematode is not a harmless form.

521. LOWNSBERY, B. F. and D. R. VIGLIERCHIO. Mechanism of accumulation of Meloidogyne hapla around roots of tomato seedlings. (Abstr.) Phytopathology 48: 395. 1958.
Evidence is presented to show that larval accumulation around tomato roots is, in part, a response to a dialyzable agent, or agents, effective at a distance from the root surface.

522. MACHMER, J. H. Effect of soil salinity on nematodes in citrus and papaya plantings. J. Rio Grande Valley Hort. Inst. 12: 57-60. 1958. (Hort. Abstr. 28: 640. 1958.)
Nematodes, including Tylenchulus semipenetrans on citrus and Meloidogyne incognita acrita on pawpaws, will tolerate levels of salts which are high enough to damage, though not to kill, their host plants.

523. MacLAGAN, D. S. Pest control in cereal crops. Scottish Agriculture 37: 158-161. 1958. (Helminth. Abstr. 27: 58. 1958.)
For control of Ditylenchus dipsaci the author recommends weed suppression, the use of the resistant oat variety Milford, and a gap of 3 years between oat crops.

524. MARTIN, G. C. Root-knot nematodes (Meloidogyne spp.) in the Federation of Rhodesia and Nyasaland. Nematologica 3: 332-349. 1958.
Meloidogyne javanica is the most common species and appears to be indigenous. M. incognita var. acrita also occurs on farm lands. M. hapla, as well as the above-mentioned species, occurs commonly in market gardens. M. arenaria has been found rarely to date.

525. McGUIRE, James M. et al. The relationship of root-knot nematodes to the development of Fusarium wilt in alfalfa. (Abstr.) Phytopathology 48: 344. 1958.
The fungus Fusarium oxysporum f. vasinfectum was combined separately with five species of root-knot nematodes and the percentage of alfalfa plants of the variety Buffalo developing wilt was determined experimentally as follows. Fungus plus Meloidogyne hapla, 95 percent; fungus plus M. javanica, 60 percent; fungus plus M. incognita, 50 percent; fungus plus M. arenaria, 50 percent;

fungus plus M. incognita var. acrita, 10 percent; fungus alone, 15 percent; nematode alone and check 0 percent.

526. MEAGHER, J. W. Nematodes as plant parasites. J. Aust. Inst. Agr. Sci. 24: 3-12. 1958. (Helminth. Abstr. 27: 38. 1958)

This is a general account of plant parasitic nematodes in Australia. The role of nematodes in disease complexes is discussed and methods of control -- cultural, chemical and biological -- are mentioned.

527. MORETON, B. D. New host record for root-knot eelworms. Plant Path. 7: 114. 1958.

Meloidogyne incognita (plus M. incognita acrita?) on pot-grown plants of Cyclamen persicum in England.

528. MOUNTAIN, W. B. and H. R. BOYCE. The peach replant problem in Ontario. V. The relation of parasitic nematodes to regional differences in severity of peach replant failure. Can. J. Botany 36: 125-134. 1958.

Two peach producing areas in Ontario differ markedly in the incidence and severity of peach replant failure. It was found that peach soil populations of Pratylenchus penetrans can be correlated with the distribution of the disease since the average soil population was 3-4 times larger in the area where peach replant failure is more severe. The distribution of the nematode is related to soil type, being most common on coarse sandy soils.

529. MOUNTAIN, W. B. and H. R. BOYCE. The peach replant problem in Ontario. VI. The relation of Pratylenchus penetrans to the growth of young peach trees. Can. J. Botany 36: 135-151. 1958.

The severity of peach replant failure is related to the soil population of Pratylenchus penetrans. Controlling this nematode with a nematocide increased the growth of replants and reduced mortality. The first nematode to attack newly developing peach roots was found to be P. penetrans. Ecto-parasites usually appeared later and could not be correlated with incidence of peach replant failure.

530. MULVEY, ROLAND H. Impregnation of Heterodera trifolii by males of H. schachtii (Nematoda: Heteroderidae). Can. J. Zool. 36: 839-841. 1958.

A parthenogenetic nematode, H. trifolii, was impregnated by a bisexual nematode, H. schachtii, in mixed cultures of the two species. No males occurred among several hundred offspring.

531. MULVEY, ROLAND H. Parthenogenesis in a cyst forming nematode, Heterodera trifolii (Nematoda: Heteroderidae). Can. J. Zool. 36: 91-93. 1958.

H. trifolii reproduced in the absence of males. Nematodes reared in the greenhouse from single larvae and from mass cyst culture were diploid-parthenogenic. During maturation only one polar body was produced. The diploid number (24?) of chromosomes was not reduced and no male was found.

532. NEWHALL, A. G. The incidence of Panama disease of banana in the presence of the root-knot and the burrowing nematodes (Meloidogyne and Radopholus). Plant Disease Reptr. 42: 853-856. 1958.

In one experiment which ran for 4 months at Changuinola, Panama, using steamed soil heavily infested with Fusarium oxysporum f. cubense, over 100 percent more Gros Michel banana plants came down with Panama disease when Radopholus similis was added to the soil. The addition of Meloidogyne sp. caused no increase in the disease during this period of time.

533. NORTON, DON C. The association of Pratylenchus hexincisus with charcoal rot of sorghum. Phytopathology 48: 355-358. 1958.

Part of the damage in Texas often attributed to Macrophomina phaseoli is due to the activity of Pratylenchus hexincisus. The two incitants apparently act independently and their effects are greater under drouth conditions.

534. NUSBAUM, C. J. The response of root-knot-infected tobacco plants to foliar applications of maleic hydrazide. (Abstr.) Phytopathology 48: 344. 1958.
Foliar application of maleic hydrazide inhibited the development of galls and reproduction of Meloidogyne incognita. Histopathological studies of the root material showed conspicuous lack of hyperplastic tissue, as well as small, poorly developed giant cells and degenerate female nematodes.

535. OOSTENBRINK, M. Enige bijzondere aaltjesaantastingen in 1957. Tijdschr. Pl. Ziekt. 64: 122. 1958.
(not reviewed)

536. OOSTENBRINK, M. An inoculation trial with Pratylenchus penetrans in potatoes. Nematologica 3: 30-33. 1958.
Potatoes were stunted the second year following inoculation but not the first year. Population of the nematode declined the first year and then markedly increased the second year.

537. PARKER, K. G. et al. Cherry and other fruit trees damaged by nematodes. Farm Res. 24(2): 10. 1958.
Damage to cherry and apple trees on light-textured soils caused by Pratylenchus penetrans.

538. PERRY, VERNON G. A disease of Kentucky blue grass incited by certain spiral nematodes. (Abstr.) Phytopathology 48: 397. 1958.
Certain species of spiral nematodes are said to be pathogenic to blue grass on the basis of greenhouse inoculation experiments, field control experiments, and pathological histological studies.

539. PERRY, V. G. Parasitism of two species of dagger nematodes (Xiphinema americanum and X. chambersi) to strawberry. Phytopathology 48: 420-423. 1958.
Inoculation experiments showed that both species cause shrunken, reddish-brown lesions on strawberry roots that progress to an eventual blackening of the entire root system. Other organisms are involved in the eventual destruction of the roots.

540. PETERS, B. G. Symposium on plant parasitic Nematoda. Proc. Linnean Soc. of London. 169: 84-85. 1958. (Helminth. Abstr. 27: 54. 1958).
(not reviewed)

541. PITCHER, R. S. and J. E. CROSSE. On a disease complex of strawberries involving a nematode and a bacterium. (Abstr.) Proc. Linnean Soc. of London 169: 105. 1958.

542. PITCHER, R. S. and J. E. CROSSE. Studies in the relationship of eelworms and bacteria to certain plant diseases. II. Further analysis of the strawberry cauliflower disease complex. Nematologica 3: 244-256. 1958.
Pure culture studies show that there are two related but distinct diseases in eelworm infested field strawberries: 1) a true eelworm disease resulting in feeding areas, alaminate leaves, and open-centered plants, caused by the nematodes alone (Aphelenchoides ritzemabosi and A. fragariae); 2) a predominantly bacterial disease, cauliflower, composed of a leafy gall initiated by the bacterium Corynebacterium fascians, and modified by the eelworms.

543. RASKI, D. J. and J. D. RADEWALD. Reproduction and symptomatology of certain ectoparasitic nematodes on roots of Thompson seedless grape. Plant Disease Reptr. 42: 941-943. 1958.
Xiphinema index, Criconemoides xenoplax, Paratylenchus hamatus, and Trichodorus christiei were tested on Thompson seedless rootings in sterile soil. T. christiei did not survive whereas the others multiplied and were parasitic. Root injury consisting of destruction, necrosis, or malformation of the feeder roots occurred only in the presence of X. index.

544. RITTER, M. and R. RITTER. Caractères du cycle évolutif d'un Meloidogyne, nématode parasite des racines de la tomate Lycopersicum esculentum, Mill. (Character of the life cycle of a Meloidogyne, a parasitic nematode on the roots of tomato L. esculentum.) Acad. Sci. C. R. 246: 1773-1776. 1958. (Tobacco Abstr. 2: 328. 1958.)

A study of life cycle and duration of larval stages of a nematode similar morphologically to Meloidogyne incognita var. acrita. No males were recovered. Total life cycle varies from 25-90 days.

545. RITTER, M. and R. RITTER. Influence de l'âge de la plante-hôte sur le développement de Meloidogyne incognita, nématode phytoparasite. (Influence of age of the host plant on the development of M. incognita, plant parasitic nematode.) Acad. Sci. C. R. 246: 2054-2056. 1958. (Tobacco Abstr. 2: 328. 1958)

Older plants are invaded earlier than young plants and permit more rapid development of Meloidogyne. The proportion of tomatoes not attacked is greater among the younger plant series.

546. RUEHLE, J. L. and J. R. CHRISTIE. Feeding and reproduction of the nematode Hemicycliophora parvana. Proc. Helminth. Soc. Wash. 25: 57-60. 1958.

H. parvana fed readily on the roots of corn and bean, feeding externally near the root tip. Feeding did not cause necrotic lesions. The most rapid reproduction occurred on corn, with an increase of about 1 to 85 in 5 months.

547. SAUER, M. R. Development of eggs before the final moults in Pratylenchus. Nature 181: 129. 1958.

Occasionally females of P. minyus were found carrying eggs outside the body but within a partly cast cuticle. It appears therefore, that this nematode may produce eggs before the final moult takes place.

548. SCHINDLER, A. F. Attempts to demonstrate the transmission of plant viruses by plant parasitic nematodes. Plant Disease Reptr. 42: 1348-1350. 1958.

Attempts to transmit tobacco mosaic virus and cucumber mosaic virus to tobacco and tomato by Meloidogyne spp. as well as carnation mottle virus to carnation by Helicotylenchus nannus and Pratylenchus spp. were unsuccessful.

549. SCHINDLER, A. F. Root-knot nematodes on the mimosa tree, Albizzia julibrissin. Plant Disease Reptr. 42: 315. 1958.

Heavy galling with Meloidogyne hapla, moderate galling with M. arenaria and M. arenaria thamesi.

550. SHER, S. A. The effect of nematodes on azaleas. Plant Disease Reptr. 42: 84-85. 1958.

Tylenchorhynchus claytoni, Trichodorus christiei, Tylenchus sp., and Ditylenchus sp. are often found around poorly growing azalea plants in southern California. T. claytoni was the only species that caused a stunting of azalea plants in a greenhouse test.

551. SIMON, LUDWIG. Nematologische Untersuchungen an Hopfen. II. Zur Morphologie und Biologie von Heterodera humuli Filipjev, 1934. Nematologica 3: 269-273. 1958.

H. humuli is regularly found in the hop growing areas of southern Germany. The larvae appear in soil samples mainly in April and May, but continue to be found in a smaller number until September. The first ripe cysts are found towards the end of July.

552. SOUTHEY, J. F. New host records for root knot eelworms. Plant Path. 7: 114. 1958.

Meloidogyne incognita var. acrita on Hoya sp., M. hapla on Clematis hybrids, Antennaria dioica, and Diervilla x styriaca in England.

553. STOVER, R. H. and M. J. FIELDING. Nematodes associated with host injury of Musa spp. in Honduran banana soils. Plant Disease Reptr. 42: 938-940. 1958. (Also Plant Disease Reptr. 42: 1302. 1958; for correction.)

Twelve species of plant parasitic nematodes were obtained from banana soils and Musa spp. roots in Honduras. Four of these, Meloidogyne arenaria, Hoplolaimus sp., Radopholus similis, and Pratylenchus musicola, were encountered consistently and in abundance. Root injury was most prevalent in sandy loam soil. There were no abnormal growth symptoms.

554. SUDAKOVA, I. M. (The eelworm fauna of the Chuvash A.S.S.R.) In Russian. Zoologicheski Zhurnal 37: 134-139. 1958. (Helminth. Abstr. 27: 68. 1958.)

The 45 eelworm species listed from 17 species of crops and weeds in Chuvash A.S.S.R. include Aphelenchoides scalacaudatus n. sp. from the roots of Raphanus sativus as well as the roots and leaves of species of Allium.

555. SUMMERS, T. E. and C. C. SEALE. Root knot nematodes, a serious problem of kenaf in Florida. Plant Disease Reptr. 42: 792-795. 1958.

The nematodes Meloidogyne incognita and M. incognita acrita damage kenaf by killing small seedlings, causing stunting and premature death of older plants and reducing fibre yields. Fumigation of root-knot-infested soils, using 40 gal./acre of chloropicrin, increased the yields of kenaf.

556. TAYLOR, A. L. and EDNA M. BUHRER. A preliminary report on distribution of root-knot nematode species in the United States. (Abstr.) Phytopathology 48: 464. 1958.

South of the latitude of Washington, D. C. the most common root knot nematodes are Meloidogyne incognita and M. incognita acrita. North of this latitude M. hapla occurs most frequently. M. hapla and M. arenaria are quite common in peanut fields in areas where this crop is grown commercially. M. javanica occurs in scattered locations in southern and southwestern states. M. arenaria thamesi has been found only in Florida. No other species of Meloidogyne have been found in the U. S.

557. TAYLOR, DONALD P., ROGER V. ANDERSON and WILLIAM A. HAGLUND. Nematodes associated with Minnesota crops. I. Preliminary survey of nematodes associated with alfalfa, flax, peas, and soybeans. Plant Disease Reptr. 42: 195-198. 1958.

A number of nematodes were identified from fields of alfalfa, flax, peas and soybeans.

558. THOMAS, PAUL R. Severe eelworm (Ditylenchus dipsaci (Kühn) Filipjev) infestation of the narcissus variety Soleil D'Or. Nematologica 3: 72-78. 1958.

During 1954, several instances of premature, slimy decay were noted in this variety of narcissus growing on the Isles of Scilly. There were very heavy infestations of D. dipsaci.

559. THOMASON, IVAN J. The effect of the root-knot nematode, Meloidogyne javanica, on blackeye bean wilt. (Abstr.) Phytopathology 48: 398. 1958.

The resistance of the variety Grant to Fusarium oxysporum f. tracheiphilum was reduced when the roots of the plants were infected with M. javanica.

560. TODD, E. H. and JOHN G. ATKINS. White tip disease of rice. I. Symptoms, laboratory culture of nematodes, and pathogenicity tests. Phytopathology 48: 632-637. 1958.

The disease is caused by an ectoparasite, Aphelenchoides besseyi. The nematode is seed-borne and in stored seed is viable for 23 months. The nematodes were cultured on fungi growing on steamed, unhulled rice and could not be cultured in the absence of the fungi. Suspensions of nematodes from cultures consistently produced white tip symptoms.

561. TOWNSHEND, J. L. The effect of Pratylenchus penetrans on a clone of Fragaria vesca. Can. J. Botany 36: 683-685. 1958.

In the presence of small numbers of P. penetrans, the net increase in the number of petioles, petiole length, and fresh weight of F. vesca plants was significantly less than that of the controls, indicating, by analogy, that the nematode may be an important primary parasite in the strawberry root-rot complex.

562. TRACEY, M. V. Cellulase and chitinase in plant nematodes. Nematologica 3: 179-183. 1958.

It is demonstrated that both chitinase and cellulase are produced by Ditylenchus dipsaci, D. destructor, and D. myceliophagus. There is some indication that polygalacturonase is produced by D. dipsaci.

563. VAN GUNDY, S. D. The life history of the citrus nematode Tylenchulus semipenetrans Cobb. Nematologica 3: 283-294. 1958.

Characteristics are described which separate male and female at the second larval stage. Unfertilized females produced both male and female larvae. No anus was observed in the female larva. An anal opening was observed in the male larva which becomes the genital opening.

564. VAN GUNDY, S. D. The pathogenicity of Hemicycliophora arenaria on citrus. (Abstr.) Phytopathology 48: 399. 1958.

At a soil temperature of 30°C gall formation and nematode reproduction on lemon roots were greater than at a soil temperature of 25°C. No galling occurred on sweet orange roots. The formation of galls on rough lemon roots is a hyperplastic response to the feeding of the nematodes. The cells adjacent to the stylet of the nematode showed hypertrophy of the nuclei.

565. WALLACE, H. R. Movement of eelworms. I. The influence of pore size and moisture content of the soil on the migration of larvae of the beet eelworm, Heterodera schachtii Schmidt. Ann. Appl. Biol. 46: 74-85. 1958.

Experiments on migration of the beet eelworm through soil fractions at different pressure deficiencies or at saturation showed that the nematode attains maximum speed when pore diameters were between 30 - 60 $\mu$. Speed of the eelworm increased as lateral displacement of the body was restricted by external resistance acting perpendicularly to the body axis. By ascertaining pore size distribution the probable behaviour of beet eelworm larvae in the medium can be predicted.

566. WALLACE, H. R. Movement of eelworms. II. A comparative study of the movement in soil of Heterodera schachtii Schmidt and of Ditylenchus dipsaci (Kühn) Filipjev. Ann. Appl. Biol. 46: 86-94. 1958.

Studies of mobility in different soil fractions and different suctions showed that the optimum particle size for movement of H. schachtii and D. dipsaci was 150-200 and 250-500 $\mu$, respectively. The effect of pore size upon mobility is discussed and it is suggested that there is a simple relationship between body length, particle size, and speed.

567. WALLACE, H. R. Movement of eelworms. III. The relationship between eelworm length, activity and mobility. Ann. Appl. Biol. 46: 662-668. 1958.

It was found that the product of length and activity of an eelworm divided by its speed is a constant. This supports the hypothesis that the speed of the eelworm among water droplets is a function of its length and activity. The principle can only be applied to movement in soil where the length of the eelworm is less than about three times the particle diameter. Under such conditions the eelworms move in thin films or water droplets over particles. With increasing eelworm length there is an increase in soil particle size for maximum mobility.

568. WALLACE, H. R. Observations on the emergence from cysts and the orientation of larvae of three species of the genus Heterodera in the presence of host plant roots. Nematologica 3: 236-243. 1958.

It is suggested that four factors influence rate of emergence of larvae from cysts and their attraction to host plant roots:

1) the concentration of root diffusate secreted by the roots; 2) the rate of diffusion of the diffusate from root to cyst; 3) gradients of moisture content in the sand caused by uptake of water by the roots; 4) inhibition of larval emergence at high suctions caused by thin water films at the oral and vulval openings of the cyst.

569. WIDDOWSON, ELIZABETH et al. Observations on the development of Heterodera rostochiensis Woll. in sterile root cultures. Nematologica 3: 308-314. 1958.

Eggs were sterilized in hydrogen peroxide and transferred to a tomato root culture in White's medium. Larvae emerging from the eggs concentrated at the root tip or at isolated points along the main roots where lateral rootlets later emerged. There was very high nematode mortality in the agar but some succeeded in penetrating root tips, usually accompanied by localized swelling. Mature females developed but contained no eggs.

570. WIDDOWSON, E. and G. H. WILTSHIRE. The potato-eelworm hatching factor. Ann. Appl. Biol. 46: 95-101. 1958.

The hatching factor from potato root diffusate has many of the properties of eclepic acid from tomato root and Solanum nigrum as well as the same biological activity. It was found that the potato preparations which are freely soluble in water are simultaneously inactivated and rendered insoluble by brief exposure to caustic alkali. The product of alkali treatment has been crystallized.

571. WIDDOWSON, ELIZABETH. Potato root diffusate production. Nematologica 3: 6-14. 1958.

Tests were made to assess the effects of plant age, variety and infestation with the potato root eelworm on the activity of potato root diffusate produced by potted potatoes.

572. WIDDOWSON, ELIZABETH. The production of root diffusate by potatoes grown in water culture. Nematologica 3: 108-114. 1958.

Diffusate was produced by potatoes growing in 1 litre of nutrient solution without aeration, but for at least the first 4 weeks of growth it was less active than that from potatoes in pots, suggesting slower initial growth of potato in nutrient solution.

573. WINNER, CHR. Untersuchungen über die Eigenschaften der auf Heterodera schachtii Schmidt aktivierend wirkenden Wurzelexsudate von Brassica rapa oleifera D. C. Nematologica 3: 315-326. 1958.

The active principle of the exudate from turnip rape can be partially destroyed by various physical and chemical means as well as by bacterial degradation. The active principle is dialysable and can be dried in vacuo at 35°C successfully. The active material occurs in higher concentration in roots than in exudate and can be extracted from the roots without difficulty.

## Nematodes -- Resistance

574. BAIN, DOUGLAS C. Reaction of red and white clover introductions to root knot nematodes. (Abstr.) Phytopathology 48: 341. 1958.

Results suggest the possibility of selecting white clovers resistant to Meloidogyne incognita var. acrita and M. javanica and red clovers resistant to M. arenaria and M. javanica.

575. CRITTENDEN, H. W. Histology and cytology of susceptible and resistant soybeans infected with Meloidogyne incognita acrita. (Abstr.) Phytopathology 48: 461. 1958.

Histological and cytological characteristics of susceptible varieties include: large number of giant cells, large size of giant cell area, very dense cytoplasm and great number of enlarged nuclei in the giant cells, great enlargement of pericycle. Almost none of these characteristics occurred in the roots of resistant varieties.

576. DROLSOM, P. N. et al. Inheritance of resistance to root-knot nematodes in tobacco. Phytopathology 48: 686-689. 1958.

Results support the hypothesis that a single dominant factor, or a block behaving as a single factor, controls resistance to the Meloidogyne incognita var. acrita populations used.

577. DROLSOM, P. N., and E. L. MOORE. Reproduction of Meloidogyne spp. in flue-cured tobacco lines of root-knot resistant parentage. Plant Disease Reptr. 42: 596-598. 1958.

Data indicated that breeding lines were highly resistant in the presence of Meloidogyne incognita and M. incognita acrita and relatively susceptible with M. javanica, M. arenaria, and M. hapla.

578. FEDER, W. A. et al. Citrus varieties, species, and relatives susceptible to attack and damage by the burrowing nematode, Radopholus similis. Plant Disease Reptr. 42: 934-937. 1958.

Nearly 400 varieties, species and relatives were found to be susceptible.

579. GILBERT, J. C. et al. Tobacco mosaic virus resistance combined with root knot resistance in new tomato hybrids. Hawaii Farm Sci. 6: 7-8. 1958. (Hort. Abstr. 28: 603. 1958.)

Not reviewed.

580. GILES, J. E. and E. M. HUTTON. Combining resistance to the root-knot nematode, Meloidogyne javanica (Treub) Chitwood, and Fusarium wilt in hybrid tomatoes. Australian J. Agr. Res. 9: 182-192. 1958. (Helminth. Abstr. 27: 11. 1958.)

The authors report the production of tomato strains resistant to root knot nematodes (M. javanica) and Fusarium wilt (Fusarium bulbigenum var. lycopersici). Four lines derived from Lycopersicon peruvianum bred in Hawaii for root-knot resistance were bred in various ways with 12 Australian commercial varieties. All of the Hawaiian lines were highly resistant to Fusarium whereas the resistance to the nematode varied in the different lines.

581. GOLDEN, A. MORGAN and THELMA SHAFER. Differential response of Heterodera schachtii, the sugar beet nematode, to selections of Chenopodium album. Plant Disease Reptr. 42: 184-187. 1958.

Of six selections of Chenopodium album tested for susceptibility to the sugar-beet nematode, one was found to be moderately infected while five were found not to be infected indicating at least two races of this plant species.

582. GOLDEN, A. MORGAN. Interrelationships of certain Beta species and Heterodera schachtii, the sugar beet nematode. Plant Disease Reptr. 42: 1157-1162. 1958.

The studies concerned three wild species of Beta (B. patellaris, B. procumbens, and B. webbiana). All produced a strong hatching factor and larvae of the sugar beet nematode penetrated their roots but mature females and cysts did not develop. None of the Beta species were affected by nematode attack. The possible nature of this resistance is discussed.

583. GOLDEN, A. MORGAN and THELMA SHAFER. Unusual response of Hesperis matronalis to root-knot nematodes (Meloidogyne spp.). Plant Disease Reptr. 42: 1163-1166. 1958.

In laboratory and greenhouse tests, Hesperis matronalis, a cruciferous plant which might be used as a trap plant for use in biological control of the sugar beet nematode, was determined not to be a host for any of the root-knot nematodes known to occur in the United States. Root-knot nematode larvae were found to enter the roots and form typical swellings but did not develop to maturity.

584. JONES, F. G. W. Resistance-breaking populations of the potato root eelworm. Plant Path. 7: 24-25. 1958.

In 1957, 25 populations of Heterodera rostochiensis were tested on a range of resistant potato material, including $F_1$ and $B_1$ hybrids of Solanum tuberosum spp. andigena and also S. vernei. Seventeen populations were aggressive to the S. andigena hybrids and none to S. vernei.

585. MANKAU, R. A. Pathological disturbances caused by Heterodera trifolii in susceptible and resistant plants. (Abstr.) Phytopathology 48: 395. 1958.

It was found that the syncytium that develops in the stele adjacent to the head of the nematode is formed by the coalescing of adjoining cells, producing a continuous, multinucleate protoplast. It increases in size by inclusion of cells at its advancing margins. The size of the female at maturity is closely related to the size of the syncytium and rate of development of the nematode is dependent upon rate of development of the syncytium.

586. McGLOHON, NORMAN E. and L. W. BAXTER. The reaction of Trifolium species to the southern root-knot nematode, Meloidogyne incognita var. acrita. Plant Disease Reptr. 42: 1167-1168. 1958.

Twenty-five species of Trifolium were tested for susceptibility to M. incognita var. acrita and all became severely galled.

587. McGUIRE, D. C. and R. W. ALLARD. Testing nematode resistance in the field. Plant Disease Reptr. 42: 1169-1172. 1958.

Successful field trials in Hawaii for testing the resistance of varieties and lines of lima beans to root-knot nematode were due to at least three factors: 1) a benevolent climate of the test areas both to the host and the pathogen; 2) relative freedom from other pathogens to complicate the tests; 3) relative uniformity of root-knot nematode infestation in the plots. Results in California and Hawaii were in close agreement suggesting that the same physiological races of root-knot nematodes were involved.

588. PATE, J. B. et al. Resistance of Hibiscus eetveldianus to root-knot nematodes and the possibilities of its use as a source of resistance in kenaf, Hibiscus cannabinus. Plant Disease Reptr. 42: 796-797. 1958.

Hibiscus eetveldianus has been found resistant and kenaf, H. cannabinus, susceptible to root-knot nematodes in south Florida. Attempts are being made to combine the root-knot resistance of the former with the plant type of kenaf in a single fertile line.

589. POWELL, N. T. and C. J. NUSBAUM. The effect of root-knot nematode resistance on the incidence of black shank in tobacco. Phytopathology 48: 344. 1958.

The studies indicate that the loss from black shank in resistant varieties of tobacco grown in the presence of both the fungus Phytophthora parasitica var. nicotianae and the nematodes Meloidogyne incognita and M. incognita var. acrita would be reduced by combining root-knot resistance with black shank resistance.

590. RIGGS, R. D. and N. N. WINSTEAD. Attempts to transfer root-knot resistance in tomato by grafting. Phytopathology 48: 344. 1958.

The experiments show that the resistance or susceptibility factor(s) is inherent in individual cells in both the roots and tops of plants and either is not translocated or does not cross the graft union.

591. ROHDE, R. A. and W. R. JENKINS. Basis for resistance of Asparagus officinalis var. altilis L. to the stubby-root nematode Trichodorus christiei Allen 1957. U. of Md. Agr. Expt. Sta. Bull. A-97. June 1958.

The resistance of asparagus variety Martha Washington to attack by T. christiei is dependent on an active force. The deleterious effects of asparagus on soil populations is more pronounced as fleshy storage roots are formed. A substance toxic to the nematode was isolated from asparagus, mainly from the storage roots. Some properties of this chemical are described.

592. ROHDE, R. A. and W. R. JENKINS. The chemical basis of resistance of asparagus to the nematode Trichodorus christiei. Phytopathology 48: 463. 1958.

Juice extracted from the roots of Asparagus officinalis was toxic to T. christiei and other nematodes at a dilution of 1: 10, causing non-reversible paralysis of nematodes in water solutions of 100 ppm or less. Populations of T. christiei around tomato roots were reduced either by spraying the leaves or drenching the root zone with 1000-ppm solution of the toxic compound isolated from asparagus roots.

593. ROSS, J. P. Host-parasite relationship of the soybean cyst nematode in resistant soybean roots. Phytopathology 48: 578-579. 1958.

In the resistant variety there is a hypersensitive necrotic reaction to the nematode (Heterodera glycines), resulting in disorganized necrotic cells about the head of the female nematode in contrast to the formation of giant cells in the susceptible roots. The development of males is normal in both resistant and susceptible varieties.

594. SHARPE, R. H. Okinawa peach shows promising resistance to root-knot nematodes. Proc. Florida State Hort. Soc. 70: 320-322. 1958. (Hort. Abstr. 28: 351. 1958.

Seedlings introduced from Okinawa are highly resistant to Meloidogyne incognita, M. incognita acrita, and M. javanica.

595. SMITH, OLIVER F. Reactions of some alfalfa varieties to the stem nematode. Phytopathology 48: 107. 1958.

Infection by Ditylenchus dipsaci of varieties of alfalfa in field plots varied from 2 percent in the resistant variety Lahontan to 100 percent in the highly susceptible varieties.

596. SPRUYT, F. J. Susceptibility of Seradella to root-knot nematodes. Plant Disease Reptr. 42: 897. 1958.

Seradella, Ornithopus sativus Brot., is not resistant to five species of root-knot nematode, Meloidogyne javanica, M. arenaria, M. hapla, M. incognita, M. incognita var. acrita.

597. STANFORD, E. H. et al. Sources of resistance in alfalfa to the northern root-knot nematode, Meloidogyne hapla. Phytopathology 48: 347-349. 1958.

Of 21 varieties of alfalfa, five related Medicago species, 54 Foreign Plant Introductions, and 200 lines of material from the California breeding program, only the alfalfa variety Vernal and a strain Hilman were highly resistant to M. hapla.

598. SUMMERS, T. E. et al. Extent of susceptibility within kenaf, Hibiscus cannabinus L., to root-knot nematodes. Plant Disease Reptr. 42: 591-593. 1958.

All kenaf varieties, introductions and selections tested were susceptible to Meloidogyne incognita and M. incognita acrita, but some exhibited variation, particularly between plants within lines.

599. WILLIAMS, T. D. Potatoes resistant to root eelworm. Proc. Linnean Soc. of London 169: 93-104. 1958. (Helminth. Abstr. 27: 54. 1958.)
Not reviewed.

## Nematodes -- Technique

600. CARROLL, K. K. et al. The potato eelworm hatching factor. 7. Further methods for concentration of the factor. Nematologica 3: 154-167. 1958.

Large quantities of potato and tomato root leachings were concentrated rapidly in vacuo at temperatures below 45°. An alternative method under investigation is to absorb the active factor by a strongly basic ion exchange resin and subsequently displacing it by mineral acid.

601. CHAPMAN, RICHARD A. An evaluation of methods for determining the number of nematodes in soil. Plant Disease Reptr. 42: 1351-1356. 1958.

The inverted flask method provided good yields adequate for many quantitative purposes with lower variability than either the Baermann funnel or the sieving-Baermann funnel.

602. DEN OUDEN, H. A new method for culturing plants enabling the observation of nematodes on growing roots. Tijdschr. Pl. Ziekt. 64: 269-272. 1958

A method for growing plants in thin layers of agar is described. The agar contains a large amount of air bubbles and is enclosed between two sheets of polythene. The method can be used for the observation of nematodes and other

root parasites requiring a well-aerated medium while attacking growing roots.

603. DUGGAN, J. J. Testing soil samples for beet root eelworm (Heterodera schachtii Schmidt). Econ. Proc. of the Royal Dublin Soc. 4: 83-89. 1957. (Helminth. Abstr. 27: 21. 1958.)

By growing beet seedlings in glass tubes, the author was able to show that an infection of one cyst per 200 cc soil could be detected by observing new cysts on the roots. The test was also found to be satisfactory in winter when the seedlings were given artificial heat and light.

604. ELLENBY, C. Preliminary observations on the colorimetric assay of the hatching factor of the potato-root eelworm, Heterodera rostochiensis Wollenweber. J. Helminth. 32: 219-226. 1958.

Promising results in the colorimetric assay of potato-root eelworm hatching factor has been obtained with picric acid and 3: 5-dinitrobenzoic acid. Both of the reagents are used for the assay of cardiac glycosides with which the hatch-factor may have affinities.

605. ELLENBY, C. and A. B. GILBERT. Solutions of potato root diffusate of low ion content. Experimentia 14: 109. 1958.

The authors give two reasons why it is desirable to obtain root diffusate solutions of very low ionic content. They report that root diffusate, virtually ion-free, can be obtained if the thoroughly washed root system is placed in a litre of ion exchange water in a polythene bucket for 24 hours.

606. FEDER, W. A. Aseptic culture of the burrowing nematode Radopholus similis (Cobb) Thorne on excised okra root tissues. Phytopathology 48: 392-393. 1958.

The nematode was surface sterilized in 1:1000 mercuric chloride and successfully cultured on excised okra root tissues growing on modified White (1943) culture medium.

607. FENWICK, D. W. and ELIZABETH WIDDOWSON. The conduct of hatching tests on cysts of the potato-root eelworm Heterodera rostochiensis (Woll.). J. Helminth. 32: 125-134. 1958.

The general principles underlying the conduct of hatching tests are described. Methods for collection of material, and for its preliminary assay are described. The information gained in this way is then used in designing hatching tests. The interpretation of the data resulting from such tests is described and limits are set between which interpretation is possible.

608. FERRIS, VIRGINIA R. and J. M. FERRIS. A simple method for making rapid routine photographs of nematodes. Plant Disease Reptr. 42: 1192-1193. 1958.

The nematode, mounted on a slide, is placed on the stage of a monocular compound microscope in a darkened room and the image of the nematode is focused on a piece of photographic enlarging paper held about 10 inches above the ocular lens. The prints actually are negative but the features are quite distinct.

609. FORD, H. W. and W. A. FEDER. Procedures used for rapid evaluation of citrus for resistance to certain endoparasitic nematodes. Proc. Amer. Soc. Hort. Sci. 71: 278-284. 1958.

Preliminary screening of test seedlings carried out in tanks and greenhouse in presence of high soil populations of the burrowing nematode. Seedlings with low root population and little root damage were then studied in Petri dishes filled with sterile sand by inoculating roots with known numbers of nematodes. The population build-up was determined after 5 days and 35 days.

610. HAGUE, N. G. The concentration of potato root diffusate under reduced pressure. Nematologica 3: 149-153. 1958.

A technique is described for concentrating potato root diffusate under reduced pressure during which very little loss of activity occurred. Studies on

the concentration-response relationship showed a hump-shaped curve. This indicates that two widely spaced concentrations of the stimulant may produce similar responses thus complicating the bioassay method of determining the activity.

611. HOLLIS, J. P. Induced swarming of a nematode as a means of isolation. Nature 182: 956-957. 1958.

A method for the isolation of Tylenchorhynchus martini from a mixed population in a soil sample.

612. MAI, W. F. Small field plots for experiments involving plant pathogenic nematodes. (Abstr.) Phytopathology 48: 263. 1958.

The use of small (5 x 8 ft.) plots bounded by 12-in. redwood boards is described for nematode experiments where uniformly infested areas are necessary.

613. SHEPHERD, AUDREY M. Experimental methods in testing for resistance to beet eelworm, Heterodera schachtii Schmidt. Nematologica 3: 127-135. 1958.

This paper describes a technique for testing the resistance of sugar beet plants to Heterodera schachtii. Seedlings are transplanted at the cotyledon stage to 2 1/2-inch pots of sterile compost and 2 weeks later 2000 larvae are added to each pot and watered into the soil. Those plants which develop less than 10 cysts on the peripheral root system are retained. These are replanted and reinoculated with nematodes and plants still showing less than 10 cysts are saved for seed.

614. TINER, JACK D. A preliminary in vitro test for anthelmintic activity. Experimental Parasitology 7: 292-303. 1958.

An in vitro micro method was developed for preliminary evaluation of the antinematode effects of chemicals. A 0.01-ml volume of a volatile solvent containing a test substance is applied to dried E. coli cells. After the solvent has evaporated a suspension of nematode inoculum is introduced. The numbers and stages of nematodes which then develop are recorded and compared with a standard control. New techniques developed in connection with the procedure are discussed.

615. WIDDOWSON, ELIZABETH. Observations on the collection and storage of potato root diffusate. Nematologica 3: 173-178. 1958.

It has been found that the major portion of the leachate in a 6 1/2-inch pot is removed by the first 50 ml of water put through the pot. Stronger diffusate was obtained from potatoes growing in soil than in sand with or without nutrients. It is also suggested that one stock of diffusate adequate for all requirements be collected and stored in bulk each season because of the variable rate of breakdown of samples stored individually.

## NUTRITION

### Nutrition -- Hosts

See also 229

616. CHRISTIE, T. Effect of some major plant nutrients on resistance of hop plants to Phytophthora cactorum (L. and C.) Schroet. A. R. Cawthron Inst. 1956-1957, 1957, pp. 34-35. (Hort. Abstr. 28: 444. 1958.)

In a limited trial there were indications that NPK and NK applications to hop plants increased their susceptibility to infection by P. cactorum. The omission of $K_2O$ and, to a lesser degree, of N appeared to check infection.

617. EDGINGTON, L. V. and J. C. WALKER. Influence of calcium and boron nutrition on development of Fusarium wilt of tomato. Phytopathology 48: 324-326. 1958.

Bonny Best tomato plants inoculated with Fusarium oxysporum f. lycopersici showed a progressive decline in severity of wilt symptoms with increase

of calcium from 5 to 500 ppm. Boron levels in a range of 0.001-10 ppm affected the trend, but not progressively: with calcium at 5 ppm, the disease was very severe at both 0.001 and 10 ppm boron; with calcium at 100 ppm, the disease index decreased significantly from 0.001 to 0.25 ppm boron; with calcium at 500 ppm, the index increased consistently, and usually significantly, with increase in boron from 0.001 to 0.25 and to 10 ppm.

Nutrition -- Organism
See also 333

## SOIL FUNGICIDES

618. GROSSMAN, F. Untersuchungen über die innertherapeutische Wirkung organischer Fungizide. I. Thiocarbamate und Thiurame. (Studies on the internal therapeutic effect of organic fungicides. I. Thiocarbamates and thiurams.) Z. PflKrankh. 64: 718-728. 1957. (Rev. Appl. Mycol. 37: 449-450. 1958.)

Nine fungicides of the thiocarbamate-thiram group were examined, at University of Göttingen, for systemic fungicidal activity in Bonny Best tomato. The plants were raised in sand culture with Hoagland's medium, to which the fungicides, in solution or in suspension in acetone, were applied. Inoculation with Fusarium oxysporum f. (F. bulbigenum var.) lycopersici was secured by clipping the roots back and dipping in a homogenized culture suspension. Fusarium wilt was reduced by pre- but not post-infection treatments with compounds of the dimethyldithiocarbamate group, including thiram, which caused severe phytotoxic effects. By contrast the ethylenebisdithiocarbamates, causing at most minor phytotoxic effects, were ineffective.

Soil Fungicides -- Cereals

619. DE TEMPE, J. Aspecten van ontsmetting met Kwikhoudende middelen bij Zomergranen. (Aspects of mercurial seed dressing of spring-sown cereals.) Tijdschr. PlZiekt. 64: 150-162. 1958. (English summary) (Rev. Appl. Mycol. 37: 714. 1958.)

Studies were made on the action of mercurial seed dressings on spring wheat infected with Fusarium spp. and spring barley infected with Helminthosporium sativum. The effects of the treatments were usually but not always favorable. Thiram, which was tested later, gave far better increases in emergence. With disease-free seed the protective action of the Hg was normally outweighed by the injurious effects.

620. PORZHENKO, V. V. (New materials for the control of seed rotting and seedling loss of flax in Ukraine.) Trud. Ukr. nauk-issled. Flax Inst., Zashch. Rast. Kiev. 1956: 32-45. 1956. (Rev. Appl. Mycol. 37: 285. 1958.)

Various fungi are listed as causal agents of seed rotting and seedling loss in Ukraine. Granosan dust at 10 kg/ton seed proved very effective in control. Formalin was ineffective.

621. ROANE, C. W. and T. M. STARLING. Effects of a mercury fungicide and an insecticide on germination, stand, and yield of sound and damaged seed wheat. Phytopathology 48: 219-223. 1958.

In various experiments with seed wheat injured by a mercury fungicide the authors found that sound seeds germinated better and yielded more grain than either cracked or chipped seed. The fungicide Ceresan M proved to be severely phytotoxic to chipped seeds, slightly toxic to cracked seeds, and nontoxic to sound seeds. The application of the insecticide Pyrenone to seed wheat had no apparent effect on seed germination or yield of grain.

Soil Fungicides -- Cotton
See also 90

622. ASHOUR, W. A. Effect of sulphuric acid, fernasan and combined treatments on emergence of cotton seeds. Ann. agric. Sci., Cairo 2: 251-255. 1957. (Rev. Appl. Mycol. 37: 722. 1958.)

At the Ain Shams University 0.25 percent fernasan seed treatment and the the same preceded by 4 min. in $H_2SO_4$ significantly increased survival of Giza 30 fuzzy cotton, with averages of 222.56 and 190.67 plants compared with 157 for untreated and 127 for $H_2SO_4$ alone. No such increase was obtained with the non-fuzzy Ashmouny.

623. BIRD, L. S., et al. Evaluation of fungicides mixed with the covering soil at planting as a control measure for the cotton-seedling-disease complex. Plant Disease Reptr. 41: 165-173. 1957.

624. RANNEY, C. D. and L. S. BIRD. Influence of fungicides, calcium salts, growth regulators and antibiotics on cotton seedling disease when mixed with the covering soil. Plant Disease Reptr. 42: 785-791. 1958.

Some of the fungicides, as well as other materials, were effective in controlling the disease. It was indicated that several of the fungicides do not give the same response over a relatively wide pH range. One combination of fungicides gave a uniform response over the range encountered in the tests.

625. RANNEY, C. D. and L. S. BIRD. In-the-furrow application of chemicals as a control for the cotton seedling disease complex. Phytopathology (Abstr.) 48: 345. 1958.

Fungicides and other chemicals mixed with the covering soil at the time of planting for controlling the cotton seedling disease complex were tested on sandy and clay soils in Texas in 1957. On a state-wide basis two materials were particularly effective: a mixture of 1 1/2 lb. 50 percent captan, 1 1/2 lb. 75 percent PCNB and 2 lb. 65 percent zineb per acre consistently gave a high stand at all locations. A 5-ppm solution of the potassium salt of gibberellic acid applied to the covering soil at 10.5 gal./acre was effective in increasing the stand at the .05 level.

626. SINCLAIR, J. B. et al. Field screening of various fungicides for control of cotton seedling damping-off. Plant Disease Reptr. 42: 1372-1375. 1958.

Tests were conducted in 1957 and 1958 and results varied. In 1957 PCNB plus captan showed the most promise for controlling cotton seedling damping-off. In 1958 the following treatments were most effective: PCNB plus captan plus zineb; captan plus zineb; PCNB plus captan; PCNB plus dichlone; PCNB plus nabam; and calcium chloride plus nabam. Mylone tended to be phytotoxic in both 1957 and 1958 field tests.

627. SINCLAIR, J. B. Reaction of four Rhizoctonia solani isolates to certain chemicals. Phytopathology (Abstr.) 48: 398. 1958.

Certain chemicals determined by greenhouse assay to be effective against damping-off of cotton seedlings were placed in out-field tests in 1957. Significant differences in stand count were noted only in the field plot from which the culture of R. solani used in the greenhouse tests was originally isolated. Greenhouse studies to test disease control by two chemical combinations (captan plus PCNB and nabam plus PCNB) against four isolates of R. solani were then carried out. Highly significant differences in percentage of healthy seedlings were found between the four isolates within both chemical treatments.

## Soil Fungicides -- Evaluation

628. BAINES, R. C. et al. Nematode and Phytophthora control by Vapam. Citrus Leaves 37: 6-8, 24, 32-33. 1957.

Vapam (sodium n-methyl dithiocarbamate) is water soluble and possesses both nematocidal and fungicidal properties. The citrus nematode (Tylenchulus semipenetrans) was effectively controlled when 272 to 475 lb. Vapam per acre was applied in 6-12 surface inches of water in basins. The low doses were effective on sandy loams and the high doses on loam soils. Brown rot fungi (Phytophthora spp.) were killed by 400 lb. Vapam per acre applied in 5-6 surface inches of water in basins on sandy loam soils. Neither citrus nematodes nor brown-rot fungi were controlled satisfactorily by injecting Vapam into soil followed by various methods of handling. For preplanting treatment of tree sites

it is recommended that Vapam be applied in basins 8 x 8 ft. or larger.

629. DOMSCH, KLAUS H. Die Prüfung von Bodenfungiciden. I. Pilz-Substrat-Fungicid-Kombinationen. (English summary) Plant and Soil 10: 114-131. 1958.

Principles for the assay of soil fungicides are interpreted from the interrelationship of soil fungus-substratum-fungicide complex. From preliminary experiments it was concluded that (a) Spores are more sensitive than mycelium, (b) the age of the mycelium, within limits, has no substantial effect on sensitivity, (c) the type of substratum on which the fungus is introduced to the experiment has a considerable effect on fungicidal action. A comparison was made of six different assay procedures using three test fungi (Pythium sp., sp., Rhizoctonia solani, and Fusarium culmorum) and three fungicides (8-quinolin sulphate, captan and TMTD). Main results are discussed from the point of view of fungistatic and fungitoxic action. All assay methods that allow measurement of partial inhibition of fungal mycelium were found to gain significance.

630. DOMSCH, KLAUS H. Die Prüfung von Bodenfungiciden. II. Pilz-Boden-Wirt-Fungicid-Kombinationen. (English summary) Plant and Soil 10: 132-146. 1958.

Experimental conditions for the assay of soil fungicides are described in which crop plants serve as indicators of the degree of control. The suitability of various types of fungi and also the most appropriate time for a soil inoculation with Pythium sp. and Rhizoctonia sp. were determined. The method of application of the fungicide influenced the success of the control as well as the accuracy of the results. Captan, PCNB and an organic mercurial compound were used as representative fungicides.

631. DOMSCH, K. H. Die Wirkung von Bodenfungiziden. I Wirkstoffspektrum. (The action of soil fungicides. I Active material spectrum.) Z. PflKrankh. 65: 385-405. 1958. (English summary) (Rev. Appl. Mycol. 37: 758. 1958.)

At Kiel-Kitzeberg, Germany, 29 products were examined for their fungitoxic and fungistatic activity against Pythium sp., Rhizoctonia solani, and Fusarium culmorum by three different methods. Among the soil disinfectants chloropicrin, vapam, and methyl bromide were best while among the products harmless to growing plants captan, thiram, and zineb, each active against at least two of the pathogens, were best.

632. FAWCETT, C. H., D. M. SPENCER and R. L. WAIN. Investigations on fungicides. IV. (Aryloxythio) Trichloromethanes. Ann. Appl. Biol. 46: 651-661. 1958.

Twenty (aryloxythio) trichloromethanes were examined for in vitro fungicidal activity against six fungi. All compounds showed a direct fungistatic effect and some exhibited a marked fumigant action. When supplied to plants through their roots, eight conferred significant systemic fungicidal protection against Alternaria solani in tomato but there was no significant protection against Botrytis fabae in broad beans.

633. GONDO, M. and T. KUBO. (Effect of some fungicides on Helicobasidium mompa Tanaka in soil.) Bull. Fac. Agric. Kagoshima Univ. 6: 101-107. 1957. (English abstract) (Rev. Appl. Mycol. 37: 677. 1958.)

The effect of methoxyethyl mercuric chloride, phenyl mercuric urate, ethyl mercuric phosphate, and n-methyldithiocarbamate hydrate on H. mompa in different soils was investigated. The results indicated a decrease in fungicidal effect except in sand owing to adsorption by soil particles.

634. HAUKE-PACEWICZOWA, T. H. (Influence of the insecticide BHC on soil microflora.) Roczniki Nauk Rolniczych Ser. A, 76: 641-657. 1957. (Chem. Abstr. 52: 18991. 1958.)

Microbiological investigations of the soils of fields treated with BHC in the autumn of 1954 and spring of 1955 were made three times during the growing season. No effect of BHC was observed on the total number and qualitative composition of soil microflora. Only slight stimulation of Azotobacter

development was noted after the application of 25 g BHC/acre. A slight stimulation of nitrifiers and of Azotobacter development was noted after applications of BHC at 60 g/acre.

635. MEULI, LLOYD J. Fungicidal compositions containing 1,4-dibromo-2-butyne. (Chem. Abstr. 52: 17603. 1958.) (U.S. 2836536).

Fungicidal compositions containing $BrCH_2C{:}\text{-}CCH_2Br$ are effective against soil fungi. Test organisms used were Fusarium solani, Pythium spp., and Rhizoctonia solani.

636. MEULI, LLOYD J. Fungicidal soil treatment (to Dow Chemical Co.). (Chem. Abstr. 52: 20864. 1958.) (U.S. 2840501).

Alkali metal salts of mono- and dihalogen-substituted hydroxypropanesulfonates are used in the fungicidal treatment of soil and growth media. Sandy loam soil samples heavily infested with Fusarium solani, Pythium spp., and Rhizoctonia were treated or untreated with compounds in various concentrations and seeded with lima beans. The compounds have the advantage that the soil can be treated and seed sown immediately. They may be used either as dusts or sprays.

637. MILLER, ROBERT E. Aryl (arylcyclohexyl) cyclohexanole as fungicides. (to Monsanto Chemical Co.) (Chem. Abstr. 52: 3246e. 1958.) (U.S. 2,809,998 Oct. 15, 1957).

A compound useful as a fungicide against Aspergillus niger and tomato wilt at 1:1000 dilution is prepared by condensing arylcyclohexanols in the presence of $K_3PO_4$ and a Cu chromite-Ni catalyst. The aryl group is preferably a phenyl group substituted on the 2, 3, 4 or 5 position; a $CH_2$ group must be connected to the carbonyl C group.

638. MUNNECKE, DONALD E. Biological assay of nonvolatile diffusible fungicides in soil. Phytopathology 48: 61-63. 1958.

Plugs of soil treated with a nonvolatile diffusible fungicide are placed upon potato dextrose agar media seeded previously with spores of Myrothecium verrucaria. After 48 hrs. the clear zones of inhibition surrounding the soil plugs are measured. The zones provide a quantitative index of the concentration of the fungicides. The technique is reproducible and dependable. The standard error of individual measurements varies with the concentration and type of fungicides used.

639. MUNNECKE, DONALD E. and R. A. SOLBERG. Inactivation of Semesan in soil by fungi. Phytopathology (Abstr.) 48: 396. 1958.

Semesan applied as an aqueous suspension to soil in cotton-stoppered flasks is inactive after 2-3 weeks in nonsterile soil but still active after 2 months in steamed soil. The inactivation is biological rather than chemical. Fungi and bacteria increased in Semesan-treated soil as the fungicidal activity decreased. Several isolates of Penicillium, Aspergillus, and Trichoderma proved to be tolerant of Semesan in agar. Inactivation of the fungicide in soils inoculated with these fungi was studied.

640. STANĚK, MILOSLAV. (The action of hexachlorocyclohexane upon soil microflora.) (In Czech.) Sbornik Československ. Akad. Zeměděl. věd, Rostlinná vyŕoba 31: 375-394. 1958. (Chem. Abstr. 52: 18990. 1958.)

Preparations with hexachlorocyclohexane (I) were found to stimulate, at low doses, the growth of a few of the soil microorganisms but all are inhibited if the doses of I are higher. They are only rarely killed off completely. Curves of the action of I were not always reproducible. The action of I is quite prolonged in the soil but varied according to external conditions. The doses of I used ordinarily for insecticidal purposes in tropical applications would not ordinarily introduce into the soil enough I to cause damage.

641. STARK, C. Zur phytotoxischen Wirksamkeit des Chloropikrin. (Phytotoxic effect of chloropicrin.) Nachrbl. Deut. Pflanzenschd. 10(2): 23-25. 1958. (Tobacco Abstr.

2: 323. 1958.)

A general summary of the effect of chloropicrin on various types of plants. In Nicotiana tabacum var. Samsoun younger plants were much more sensitive than older plants.

642. TAKEUCHI, H. and H. IDE. Studies on the soil fungicides. I. Fungicidal action of the organic mercury compounds in the soil. Ann. Phytopath. Soc. Japan 22: 4-5; 197-200. 1957. (Japanese. Abs. from English summary) (Rev. Appl. Mycol. 37: 758. 1958.)

Four organic Hg compounds were assayed against Ophiobolus sativus as soil-fungicide mixtures and the soil and filtrate were assayed again after washing. The results suggested that methyl mercury iodide combined with soil without losing fungicidal activity. Ethyl mercury phosphate was fairly fungicidal initially but lost its activity after washing.

643. TIMS, EUGENE C. Treatment of pink-root-infested soil with Vapam and Mylone. Phytopathology (Abstr.) 48: 398. 1958.

Soil from two sources heavily infested with the pink root fungus Pyrenochaeta terrestris, as well as soil or sand artificially inoculated with the fungus, was used in greenhouse tests. Vapam and Mylone were used at different rates. Vapam gave almost complete control of the disease in naturally infested soil at all the rates used. Mylone gave good control at the heavier rates but at the lower rates there was some pink root development.

644. TOPPS, J. H. and R. L. WAIN. Investigations on fungicides. III. Fungitoxicity of 3- and 5- alkyl-salicylanilides and para-chloroanilides. Ann. Appl. Biol. 45: 506-511. 1957. (Chem. Abstr. 52: 4091. 1958.)

At a concentration of 4 ppm the compounds had little effect on the mycelial growth of Pythium ultimum, Verticillium albo-atrum, Alternaria solani, Aspergillus niger, and Botrytis cinerea, but they were active against Monilia fructigena. The chloroanilides usually induced less retardation than the corresponding anilides. Salicylanilide gave the greatest over-all inhibition of the fungi.

645. BAYER 22555. Chemagro Corporation, New York. Agr. Chem. 14: 41. 1959.

An experimental soil fungicide and seed treatment. Chemically P-dimethyl amino benzenediazo sodium sulfate. Reported to exhibit special merit as a seed treatment chemical on sugar beets, peas and beans. Also effective for some uses as a soil fungicide.

646. NEW SOIL FUMIGANT FOR SEED BEDS. Tobacco U.S.A. 145: 18-19. 1957. (Coresta No. 1: 1182. 1958.)

A report of Crag Mylone as a new soil fumigant sold as a wettable powder (85 percent). It may be used dry or in water solution (drench or spray) at the rate of 30 g/$m^2$. Treatment of seedbed soil must be in autumn when soil is still warm and may be left uncovered and sown not less than 1 1/2 months after treatment. The product controls weeds, cryptogams, and nematodes.

## Soil Fungicides -- Forage Crops

647. DAVIDE, ROMULO G. Effects of several fungicides for seed treatment of corn. Philippine Agriculturist 41: 295-305. 1957. (Chem. Abstr. 52: 17593. 1958.)

Phytomycin and Panogen as liquids and Arasan, Granosan, Phygon, PCNB, Gy-cop (a Cu fungicide) and dieldrin as dusts when used as seed treatments of corn seed gave increased yields of yellow flint and white flint corn. Arasan gave the highest yields. No phytotoxic effects were observed on the seedlings.

648. LEONT'EVA, MME. Y. A. and B. S. GERASIMOV. (Timing of treatment of maize grain with mixture of granosan with hexachlorane and mercuran.) Izv. Kuybysh. s.-kh. Inst. 12, pp. 73-79. 1957. (Rev. Appl. Mycol. 37: 473. 1958.)

Treatment of maize grain with mercuran or a mixture of granosan and hex-

achlorane immediately before sowing reduced root rot caused by Diplodia.

649. NEMLIENKO, F. E. (Control of maize diseases during the pre-sowing and sowing periods.) Zasch. Rast. (Plant Prot., Moscow) 1957, 2, pp. 32-35. 1957. (Rev. Appl. Mycol. 37: 280. 1958.)

The damage by fungi to stored maize is reviewed. Granosan proved the best seed treatment with mercurane next. The latter gave much better results with seed sown in black soil. In dry brown humus soil 1 kg/ton granosan and 1.5 kg/ton mercurane are effective but in black and podsolized soils 1.5 kg and 2 kg respectively were better.

## Soil Fungicides -- Fruit

650. KLOTZ, L. J., PO-PING WONG and T. A. DeWOLFE. Damping-off of sweet orange seedlings by Rhizoctonia solani controlled with biphenyl. Plant Disease Reptr. 42: 464-466. 1958.

The authors found that biphenyl vapors control damping-off of citrus caused by Rhizoctonia solani but is not useful where other organisms are involved.

## Soil Fungicides - Laboratory Tests

651. ENDE, G. v.d. and K. VERHOEFF. (Willie Commelin Scholten, Baarn, Neth.) Action of copper compounds on fungus growth in vitro. Tidjdschr. Plantenziekten 63:200-208. 1957. (German summary).

Various fungi growing in potato agar and Czapek-Dox agar containing 0.1 to 2.0 percent $CuCO_3$ (I) or Cu oxychloride (II) produced acidic metabolic products which converted the Cu compounds to a colorless insoluble crystalline substance. Fusarium oxysporum grew well in all concentrations of I and II but Cercospora beticola grew well only in media containing 0.1 and 0.3 Cu.

652. WELVAERT, W. and R. VELDEMAN. Invloed van chemische grondontsmettings- middelen op de grondschimmelflora. (Influence of chemical soil disinfectants on the soil fungus flora.) Meded. LandbHogesch. Gent, 22: 499-504. 1957. (English summary) (Rev. Appl. Mycol. 37: 757. 1958.)

Tests of normal garden soil were made before and three days after treatment with six commercial products used as soil disinfectants against fungi by plating samples on a mineral salts-peptone-dextrose agar plus rose bengal. The chemicals used varied in effectiveness but practically complete elimination of fungi was obtained with chloropicrin, formalin, and chlorobromopropene.

## Soil Fungicides -- Ornamentals

653. ANZALONE, L. Jr., and A. G. PLAKIDAS. Control of flower blight of camellias in Louisiana with fungicides. Plant Disease Reptr. 42: 804-806. 1958.

Two soil drenches, each of 300 lb/acre, of Terraclor on plots artificially infested with sclerotia of Sclerotinia camelliae from camellia completely inhibited the development of apothecia.

654. BEAUMONT, A., J. P. CLEARY and J. H. BANT. Control of damping-off of zinnias caused by Alternaria zinniae. Plant Path. 7: 53-54. 1958.

In seed treatment tests dry treatments showed marked superiority over the wet. Hot water treatment at 125°F for 25 minutes reduced the germination by 14 percent in the variety Polar and by 26 percent in Grenadier. In general, thiram dust treatment gave satisfactory control and was regarded as the most convenient and safest treatment.

655. CIFFERRI, R. and A. CORTE. In proceedings of the second Convention on non-copper fungicides, Turin, 17 November 1956.) Notiz. Malatt. Piante, 1957, 40-41, pp. 1-211. 1957. (Rev. Appl. Mycol. 37: 16-18. 1958.)

Good control of Fusarium yellows (F. orthoceras (F. oxysporum) f. gladioli) was given by soil fumigation with Vapam at 240-480 kg/ha.

656. DE BOER, S. Ziekten by clematis en rododendron veroorzaakt door schimmels uit de bodem. (Soil-borne fungus diseases of clematis and rhododendron.) Tijdschr. PlZiekt. 64: 120-121. 1958. (Hort. Abstr. 28: 462. 1958.)

Soil treatment with TMTD and zineb has shown some reduction in infection of clematis by Phytophthora spp. Present recommendations for Phytophthora control on clematis and rhododendron are the destruction of infected plants and soil sterilization with formalin.

657. OLSEN, C. M. and M. M. AFANASIEV. Root rot of sweet peas. Proc. Mont. Acad. Sci. 16: 37-38. 1956. (Rev. Appl. Mycol. 37: 239. 1958.)

A root rot of sweet peas has become prevalent in Bozeman, Montana. The plants grow normally at first, but when in bloom yellowing occurs, followed by necrosis of the vascular tissues and complete drying up of the plant. In 12 plots pre-planting applications of CBP (chlorobromopropene) at 1.5 ml/hole spaced 1 ft. apart, and Vapam 4-S at 1520 ml/100 sq. ft., diluted in water and sprinkled on top of the soil, both followed by a water seal, gave 70.1 and 72.7 percent healthy plants respectively, compared with 58.9 percent and 39.8 percent in the untreated plots. All the 22 isolates from diseased plants proved to be Fusarium spp.

658. PETERSEN, L. J. and RALPH BAKER. Dips and drenches for the control of Fusarium stem rot of carnations. Phytopathology (Abstr.) 48: 397. 1958.

Carnation cuttings infested with Fusarium roseum f. cerealis were dipped 10 minutes in various solutions and suspensions of fungicides in attempts to eradicate this inoculum from cuttings. Results indicated that Panodrench 4 (3.0 ppm cyano (methylmercuri guanidine)), Panogen experimental material No. 13849 (3.0 ppm active ingredient) and ferbam (1000 ppm ferric dimethyldithiocarbamate) were effective in control.

659. STESSEL, G. J. Botrytis control in stored rose stocks. Plant Disease Reptr. 42: 396-398. 1958.

Laboratory and storage experiments to evaluate various chemicals for effectiveness in controlling gray mould of dormant rose bushes in cold storage caused by Botrytis sp. Of the non-volatile chemicals tested in the laboratory Captan 50W produced greatest inhibition of Botrytis growth in culture; of the volatile chemicals biphenyl was most effective. The most effective dip treatments were Dowicide A and Mycostatin. The volatile chemicals and Terraclor and captan dust were also effective.

## Soil Fungicides -- Special Crops

See also 91

660. CLEARY, J. P. Control of cobweb disease of mushrooms. Plant Path. 7: 74-75. 1958.

Dusting of beds with PCNB was effective in reducing damage from the cobweb disease caused by Dactylium dendroides. PCNB was applied twice at the rate of 1 lb. 20 percent PCNB per 1000 sq. ft. without injury to the mushrooms. If the dust was mixed with the casing material (peat-chalk mixture) mushroom production was almost entirely suppressed.

661. GOODMAN, R. N. The effect of pentachloronitrobenzene (PCNB) on mushroom production. Plant Disease Reptr. 42: 444-446. 1958.

It was found that PCNB applied at 250 ppm or higher to mushroom beds 24 hrs. after casing delayed and curtailed production. When the material was applied after harvest of the first break, concentrations as high as 1000 ppm did not affect yield adversely.

662. GOSS, ROBERT C. Studies on the control of Verticillium wilt of peppermint with CBP-55. Plant Disease Reptr. 42: 177-179. 1958.

Satisfactory commercial control of Verticillium wilt of peppermint was obtained, as evidenced by the total plot areas free from infection. In the non-treated plots 61.4 percent of the area was estimated to be free from infection, while 75.1, 79.1, and 85.4 percent of the 40-, 80-, and 120-gallon per acre

plots, respectively, were free from infection.

663. HARRISON, A. L. and G. M. WATKINS. Terraclor for the control of southern blight of peanuts. Phytopathology (Abstr.) 48: 343. 1958.

Applications of Terraclor (75 percent pentachloronitrobenzene) as a spray to the crown of Spanish peanuts with each cultivation, for the control of southern blight (Sclerotium rolfsii), gave significant increases in yield of nuts at the 1 percent level in 1956 and 1957. Zineb and captan applied in the same manner were ineffective. Terraclor gave some indication that it may reduce southern blight when mixed in the soil before planting.

664. STEFANOV, D. and VYLCHEV, S. Massnahmen zur Bekämpfung der Pilz- und Bakterienkrankheiten bei Tabaksetzlingen. (Control measures for fungous and bacterial tobacco seedling diseases.) Bulgar Tiutiun 3: 12-15. (Bulgarian.) (Tobacco Abstr. 2: 567. 1958.)

665. TOMLINSON, J. A. Crook root of watercress: The control of the disease by zinc-fritted glass and the mechanism of its action. Ann. Appl. Biol. 46: 608-621. 1958.

Zinc, used as zinc sulphate at 0.5 ppm, was found to inhibit the growth of Spongospora subterranea (Wallr.) Lagerh. f. sp. nasturtii Tomlinson, the cause of crook-root disease of watercress. A relatively insoluble finely powdered glass frit containing zinc oxide (zinc frit) largely prevented infection by this fungus when added, at 0.2g/350 ml, to water in which watercress was growing.

666. TOMLINSON, J. A. Crook root of watercress. I. Field assessment of the disease and the role of calcium bicarbonate. Ann. Appl. Biol. 46: 593-607. 1958.

The discovery, occurrence, and symptoms of the disease caused by Spongospora subterranea (Wallr.) Lagerh. f. sp. nasturtii Tomlinson are described. Water from certain natural sources contained a factor which inhibited crook root and which was shown to be calcium bicarbonate. In laboratory tests, increasing concentrations of calcium bicarbonate from 62 to 540 ppm gave an increasing degree of control of the disease. The same effect was shown in a small field test.

## Soil Fungicides -- Technique

667. GASIORKIEWICZ, E. C. Bioassay test for the detection of pentachloronitrobenzene. Phytopathology (Abstr.) 48: 261. 1958.

In phytocidal and fungicidal tests with PCNB inhibition of the common wood sorrel (Oxalis repens Thunb.) was noted. O. repens was found to be a diagnostic bioassay test plant for determining the persistence of PCNB in treated soils.

668. JOHNSON, F. R. and A. M. HILLIS. A fluorescent mineral tracer technique to determine fungicide placement in the soil profile. Plant Disease Reptr. 42: 287. 1958.

A synthetic fluorescent mineral, zinc orthosilicate, was found to be a good tracer to use in evaluation of equipment for proper application of fungicides in soil treatment. Cross-sections of the treated soil profiles were compared for proper location of the fungicide and on the basis of these comparisons it was found possible to make recommendations.

669. LINDEN, G. and P. SCHICKE. Untersuchungen über die fungizide und herbizide Wirkungen von Vapam im Boden und Berücksichtigung von Eindringtiefe, Adsorption und Karenzeit. (Studies on the fungicidal and herbicidal action of Vapam in the soil in respect to depth of penetration, adsorption and waiting time.) Meded. LandbHogesch. Gent, 22: 399-418. 1957. (English summary.) (Rev. Appl. Mycol. 37: 703. 1958.)

Vapam was applied at 100 ml/sq. m. by drenching, mixing in, and injection into soil contained in glass cylinders inoculated with various soil organisms. Drenches are limited to the upper layers of soil, not penetrating below 20 cm even when the soil is dry. Lettuce is particularly susceptible to Vapam and could be used as an indicator of Vapam residues.

670. LINDSTRÖM, OLLE. Mechanism of liquid seed treatment. Vapor action and adhesion, radioactive studies of initial liquid distribution and investigations with radioactive Panogen formulations. J. Agr. Food Chem. 6: 283-298. 1958.

The mechanism of liquid seed treatment using Panogen was studied by physical and chemical methods. The processes were studied by means of volatile and non-volatile tracers and the distribution was characterized by statistical methods. Panogen mercurials penetrate the fruit coat rapidly but diffusion stops at the endosperm. Liquid seed treatment may be improved further by reduction of the liquid volume.

671. MUNNECKE, DONALD E. The persistence of nonvolatile diffusible fungicides in soil. Phytopathology 48: 581-585. 1958.

Solutions or suspensions of four nonvolatile, diffusible fungicides were added to flasks containing sterilized or untreated mixtures of peat moss and sand plus fertilizers. Samples of the soil were bioassayed for diffusible fungicidal activity at intervals up to 150 days after the fungicides were applied. Under the conditions provided captan was very stable. Semesan was rapidly inactivated biologically and nabam and ferbam were inactivated nonbiologically. Semesan also declined nonbiologically, a slow-acting factor being operative in the absence of microorganisms.

672. NEWHALL, A. G. An improved method of screening potential soil fungicides against Fusarium oxysporum f. cubense. Plant Disease Reptr. 42: 677-679. 1958.

The fungicidal capacity of different chemicals was tested by percolation through a column of soil in which discs of the fungus were placed at different depths and later removed for viability tests. Many of the usually effective fungicides were found to be rendered ineffective on their way through soil. Of 36 materials tested four were found to have unusual capacity to penetrate and kill F. oxysporum f. cubense at depths down to 7 inches at dilution of 200 ppm.

673. RANNEY, C. D. and A. M. HILLIS. A study of the distribution of in-the-furrow applied fungicides. Phytopathology (Abstr.) 48: 345. 1958.

A study was conducted of the distribution of fungicides applied at planting to the seed furrow as dusts and sprays. A fluorescent indicator was used to determine the placement and degree of dispersion of the fungicide in the furrow and covering soil. Various distribution patterns were obtained and the study indicated the necessity of using an opening device that produces a seed furrow with a narrow bottom. Results indicate that a surface coverage of a fungicidal material may reduce postemergence losses.

## Soil Fungicides -- Trees

674. HODGES, C. S. Jr. Black root rot (cause unknown). Proc. Assoc. Southern Agr. Workers, 54th Annual Convention, Birmingham, Alabama, Feb. 1957. (Plant Disease Reptr. Suppl. 251: 71. 1958.)

A summer survey was conducted in 1956 covering 16 pine nurseries in six southern states to determine the prevalence of black root rot. The disease was found in four of the 16 nurseries. Its cause is not known. Fumigation with methyl bromide at several nurseries not only controlled root rot but increased the size and vigor of the seedlings as well. Vapam also gave good control in test treatments.

675. MILLER, H. N. Annual Report of the Agr. Exp. Sta. Florida for the year ending June 30, 1957, 397 pp.

Of the soil fungicides tested in nursery plots the most effective against Pythium root rot of Chinese evergreen (Aglaonema modestum) was Vapam at 109 gal/acre, while Crag Mylone (300 lb.) gave the best control of Rhizoctonia root rot of Philodendron.

676. VOLGER, C. Probleme der Bekämpfung von pilzparasitären Keimlingskrankheiten bei Nadelbäumen. (Problems in the control of parasitic fungal seedling diseases of conifers.) Meded. LandbHogesch. Gent, 22: 517-525. 1957. (English summary.) (Rev.

Appl. Mycol. 37: 743. 1958.)

Of 15 preparations tested at Göttingen University, Germany, only thiram seed dressing effectively protected pine seedlings raised in soil from a seed bed infected with spp. of Rhizoctonia, Fusarium, and Botrytis and inoculated with Pythium debaryanum. It appeared to have a systemic action.

## Soil Fungicides -- Turf

677. ZUMMO, NATALE and A. G. PLAKIDAS. Brown patch of St. Augustine grass. Plant Disease Reptr. 42: 1141-1147. 1958.

The authors report a study of the cause and control of brown patch of St. Augustine grass. Evidence is presented that the disease is caused by Rhizoctonia solani Kuehn. Of various fungicides tested for control of the disease Terraclor gave perfect control in every test at all rates ranging from 20 g to 136 g per 100 sq. ft. At the higher rate it was phytotoxic. Puratized 177 and Puratized Agricultural Spray also gave promising but variable results. All the other fungicides were ineffective at the rates tested.

## Soil Fungicides -- Vegetables

See also 14, 314

678. ASHOUR, W. A. and M. M. EL-KADI. (Damping-off disease of tomato seeds and its control.) Ann. Agr. Sci. Cairo 1: 111-126. 1956.

679. BARTZ, J. F. and K. C. BERGER. Urea-formaldehyde concentrate-85, a promising control for potato scab. J. Agr. Food Chem. 6: 675-677. 1958.

Urea-formaldehyde concentrate-85 (UF-85) when applied broadcast at a rate of 150 gal. per acre, was effective for controlling common scab (Streptomyces scabies) on the Irish Cobbler variety in 1956 and the Chippewa variety in 1957. Stands were reduced by 42 percent when potatoes were planted immediately after the UF-85 had been applied broadcast at a rate of 250 gal. per acre, while rates of 50 and 150 gal. had no effect on stand. At a rate of 150 gal. per acre, UF-85 reduced the scab index from 14.5 in the check to 0.8 in 1956 and in 1957 this rate reduced the scab from 22.0 to 1.5. Pentachloronitrobenzene was also tested. Scab incidence with the 50-gal. rate of PCNB was higher than with the previously mentioned treatment.

680. BLANCO, LEOFIN C. Comparative effects of Arasan, Granosan and Semesan dust treatments on vegetable seeds as a control for damping-off. Araneta J. Agr. 4: 57-64. 1957. (Chem. Abstr. 52: 4915. 1958.)

Under field conditions Arasan, Granosan and Semesan were effective protectants for cabbage, cauliflower and mustard; Arasan and Semesan for radish; and only Arasan for lettuce.

681. BROOK, M. and C. G. C. CHESTERS. The use of tetrachloronitrobenzene isomers on lettuce. Ann. Appl. Biol. 46: 159-166. 1958.

Field experiments were carried out on winter lettuce grown in boxes under glass and in the open, and on commercial crops in unheated greenhouses. Each of the three isomers of tetrachloronitrobenzene, applied as 5 percent dusts at 1/4 and 1/2 oz. per sq. yd. of bed, gave significant protection against Botrytis, but the 2:3:4:5 isomer was inferior to the other two, and they all delayed the hearting of the crop.

682. BURGIS, D. S. and A. J. OVERMAN. Chemicals which act as combination herbicides, nematocides and soil fungicides. I. Effect on field-seeded tomatoes. Proc. Fla. hort. Soc. 70: 137-139. 1958. (Rev. Appl. Mycol. 37: 681. 1958.)

In an experiment at the Gulf Coast Experiment Station, Bradenton, with fumigants applied before planting to spring tomato beds, Pellicularia (Sclerotium) rolfsii appeared in the field late in the season. Untreated plots suffered a 40 percent loss of plants while those given DD and AA (allyl alcohol) or ethylene dibromide had only 11 percent and 16 percent loss, respectively. Popula-

tion studies of Trichoderma and Fusarium in treated soils indicated that Vapam-4S, Crag Mylone 40 WP, AA plus DD, and drenches of AA or V-C13 were all effective fungicides. In spring Vapam, Crag Mylone, and AA, alone and mixed with EDB or DD, reduced the numbers of colonies of Fusarium for at least 61 days; EDB alone also reduced the fungal populations. The mixtures appeared to increase the fungicidal ability of AA. Invariably, the soil treatments which proved to be the best herbicide-nematocide-fungicides produced the greatest yields.

683. BUSCH, L. V. Silver scurf on muck potatoes. Plant Disease Reptr. 42: 441-443. 1958.

In laboratory assays of 21 fungicides for toxicity to the potato silver scurf organism, Helminthosporium atrovirens, only five proved satisfactory, namely, Puraseed, Semesan Bel, Karathane, Terraclor, and Manzate. The possible value of seed-piece treatment in controlling the disease is discussed.

684. CETAS, R. C. The use of sodium methyl dithiocarbamate for the control of clubroot of crucifers. Plant Disease Reptr. 42: 324-328. 1958.

Sodium methyl dithiocarbamate (31 percent) applied either as a drench, by broadcasting, or by seed treatment resulted in good control of clubroot of crucifers as well as satisfactory control of weeds.

685. CHAMBERS, S. C. Control of target spot, Alternaria solani Ell. & Mart., on potatoes. J. Dept. Agr. Vict. 55: 110-114. 1957.

Target spot was controlled most effectively by the application of maneb or zineb (2 lb. per 100 gal. per acre) as soon as the disease appeared on the crop, followed by treatments every 7-14 days for a further 4-6 weeks. Yields were increased by the treatments.

686. DEKKER, J., O. M. VAN ANDEL and A. KAARS SIJPESTEIJN. Internal seed disinfection with pyridine-2-thiol-N-oxide and a derivative. Nature 181: 1017. 1958. (Chem. Abstr. 52: 17595. 1958.)

2-Pyridinethiol N-oxide (I) and (2-pyridyl N-oxide) isothiourea-HBR (II) proved to be fungicidal agents for pea and bean seeds infected with Ascochyta pisi and Colletotrichum lindemuthianum. Though volatility of I facilitated penetration into seeds; II is not volatile and may give rise to I under physiological conditions.

687. FINK, HARRY C. Potato seed-piece treatments. Phytopathology (Abstr.) 48: 261. 1958.

Results from 3 years' experiments with potato seed-piece treatments indicated that combinations of fungicides and streptomycin sulfate may result in stands and yields significantly lower than those obtained when no treatments were used. Inclusion of a third pesticide in the combination may add to or negate the ill effects. In all eleven fungicides were tested alone or in combination with streptomycin sulfate or with dieldrin and streptomycin sulfate.

688. LOPEZ, M. A. Efectividad de varios fungicidas en la represión del "damping-off" y de la pudrición de semillas de frijol (Phaseolus vulgaris L.). (Effectiveness of various fungicides in the control of damping-off and seed decay in beans (Phaseolus vulgaris L.).) Acta agron. Palmira 7: 141-163. 1957. (English summary.) (Rev. Appl. Mycol. 37: 692. 1958.)

A review of recent literature dealing with seed treatment to control damping-off with special reference to bean seeds. Sclerotium sp., Fusarium sp., and Rhizoctonia sp. were found to be the most prevalent fungi associated with this in the Cauca Valley (Colombia) and agrox, ortho seed guard and orthocide 75 (all at 2 oz. per 100 lb. seed) gave significantly better stands than the controls or six other chemicals tested.

689. MENZIES, J. D. Dosage rates and application methods with PCNB for control of potato scab and Rhizoctonia. Am. Potato J. 34: 219-226. 1957.

Potato scab (Streptomyces scabies) was controlled in an irrigated sandy loam by application of pentachloronitrobenzene at 50 lb. per acre broadcast before planting and mixed by discing or rotary tillage. Mixing of the chemical in the top 2 in. of soil proved ineffective even at 80 lb. of the chemical per acre. The stem-canker stage of Rhizoctonia was controlled with 10-20 lb. per acre and the tuber sclerotia stage was controlled with 40-50 lb. per acre.

690. NATTI, J. J. et al. Value of insecticide-fungicide combination treatments as protectants for seed of cucumber and winter squash. Plant Disease Reptr. 42: 127-133. 1958.

Insecticide-fungicide combination treatments (captan and thiram, each at two dosage rates combined with dieldrin, heptachlor, and lindane), regardless of dosage of the pesticides, gave better total stands, in most instances, than treatments with fungicides alone.

691. OVERMAN, A. J. and D. S. BURGIS. Chemicals which act as combination herbicides, nematocides and soil fungicides. II. Effect on soil microorganisms. Proc. Fla. hort. Soc. 70: 139-143. 1958. (Rev. Appl. Mycol. 37: 681. 1958.)

See abstract No. 682.

692. POTTER, H. S., C. K. CLONINGER and A. DROST. Foliar and soil applications of chemicals for the control of pink rot of celery. Quart. Bull. Mich. Agr. Exp. Sta. 40: 734-739. 1958. (Rev. Appl. Mycol. 37: 693. 1958.)

Four organic fungicides were applied to the soil in 11 different combinations before planting the variety Utah 16 to control Sclerotinia sclerotiorum. Best results were obtained with dust applications of 20 percent Terraclor at 75 lb./acre (7.5 percent infection) or two sprays of 75 percent wettable powder at 20 lb./150 gal./acre (3.5 percent).

693. WATKINS, G. M., H. C. MOHR and P. A. YOUNG. Control of southern blight in tomatoes in northeast Texas. Phytopathology (Abstr.) 48: 346. 1958.

At a site in northeast Texas various degrees of control of southern blight (Sclerotium rolfsii Sacc.) resulted in 1957 from applications of PCNB, Vapam, calcium nitrate, or mixtures of PCNB with captan. Materials were tested both in dry and wet form.

694. WILHELM, STEPHEN, L. C. BENSON, and J. E. SAGEN. Studies on the control of broomrape on tomatoes. Soil fumigation by methyl bromide is a promising control. Plant Disease Reptr. 42: 645-651. 1958.

Satisfactory control of Orobanche ramosa L. was obtained by the use of methyl bromide applied either by a mechanical circulator under polyethylene tarpaulins or by a tractor and chiselled into the soil and followed immediately by tarping.

695. YOUNG, ROY A. and W. J. TOLMSOFF. Current season and residual effects of Vapam soil treatments for control of Verticillium wilt of potatoes. Plant Disease Reptr. 42: 437-440. 1958.

Over a period of 3 years Vapam at rates of 160 or more pounds per acre was effective in controlling Verticillium wilt of potatoes. When Vapam was blade-injected into the soil 6 inches deep at rates of 160, 165, or 190 pounds per acre increases of more than 5 tons per acre resulted. Yields from soil treated during the previous year with 190 or 165 pounds of Vapam per acre were approximately 50 sacks per acre greater than yields from the untreated check plots.

696. ANNUAL REPORT OF THE AGRICULTURAL EXPERIMENT STATIONS FLORIDA FOR THE YEAR ENDING JUNE 30, 1957. 397 pp. (Rev. Appl. Mycol. 37: 699-702. 1958.)

W. D. Moore and R. A. Elliston found that Vapam, pentachloronitrobenzene, and a combination of 36 percent PCNB plus 25 percent captan significantly reduced post-emergence damping-off of beans (Phaseolus vulgaris) due to

Pythium, and stem lesions caused by Rhizoctonia and Pythium. Surface applications of the PCNB-captan combination after sowing greatly increased stands of capsicum. In experiments by R. O. Magie a thimerosal dip controlled Fusarium oxysporum f. gladioli and Curvularia trifolii on gladiolus corms.

## SOIL INSECTS AND FUNGI

697. DICKASON, E. A., C. M. LEACH, and A. E. GROSS. Control of the clover root curculio on alsike clover. J. Econ. Ent. 51: 554-555. 1958.

In Oregon, the clover root curculio, Sitona hispidula (Fabr.), is believed to be a major cause of decline in alsike clover seed yields because of reduction in plant vigor and stand and possibly increased fungus root-rot injury associated with the insect injury. Emulsifiable concentrate heptachlor, at 4 lb. actual toxicant per acre, was applied in the spring. Oats were sown and the stubble was seeded in late autumn with alsike. In the two following seasons injury to alsike roots by the insect was greatly reduced. There were no marked differences between treated and untreated plots in the incidence or severity of root rots of 2-year-old plants.

698. KIRKPATRICK, R. A. and G. M. DUNN. Observations on insects and fungi associated with taproot survival of white clover in New Hampshire. Plant Disease Reptr. 42: 819-820. 1958.

Trifolium repens L. seeded in the spring of 1956 had a few roots diseased by Fusarium oxysporum (Schlecht.) in the fall. A heavy attack by clover root curculio larvae, Sitona spp., occurred in the spring of 1957. Thereafter root rot developed rapidly, mainly due to F. oxysporum. Study of the relationship of curculio larvae to the root rot complex and the persistence of white clover is being continued.

699. TARR, S. A. J. Experiments in the Sudan Gezira on control of wilt of Dolichos bean (Dolichos lablab) associated with attack by cockchafer grubs (Schizonycha sp.). Ann. Appl. Biol. 46: 630-638. 1958.

Wilt of the dolichos bean appeared to be due primarily to cockchafer grubs attacking the hypocotyls or roots of plants for as long as 6 weeks after sowing. Many wilted plants also showed symptoms of ashy stem blight (Macrophomina phaseoli), which probably was a secondary invader that rotted roots weakened or damaged by unfavourable soil conditions or cockchafer grubs. A powdered seed dressing containing 1 percent mercury and 20 percent dieldrin was recommended for control.

## TOXINS AND OTHER SUBSTANCES OF BIOTIC ORIGIN

### Microbial Origin -- Affecting Plants

700. BRIAN, P. W. The role of toxins in plant disease. Outlook on Agriculture 2 (1): 27-32. 1958.

Examples were discussed to indicate the kind of evidence available and to illustrate the fact that the evidence of intervention by toxins is fairly conclusive in some diseases, though less convincing in others. It seems probable that it shall be found that toxins do play a part in producing disease symptoms, but only a part, other mechanisms of importance also being involved. Many bacterial and fungal pathogens release pectin-degrading enzymes in plants, causing soft-rot. Pectic enzymes may also be concerned with symptom development of wilt diseases and may also have a direct toxic action on plant cells. Therefore, development of enzyme inhibitors may alleviate many plant diseases. However, a search for either fungicides or fungistatic agents may be more rewarding than a search for toxin antidotes.

701. CURTIS, R. W. Curvatures and malformations in bean plants caused by culture filtrate

of Aspergillus niger. Plant Physiol. 33: 17-22. 1958.

When the growing point of a bean plant is treated with the culture filtrate of a fungus identified as A. niger marked curvatures and malformations are produced on the developing shoot.

702. KRASIL'NIKOV, N. A. (Microbial antagonists and antibiotic substances as factors increasing plant resistance to infection.) Bull Acad. Sci. U.S.S.R., Ser. Biol. 23: 170-182. 1958. (Rev. Appl. Mycol. 37: 574. 1958.)

It was demonstrated that micro-organisms may produce antibiotics at a high rate in soil containing organic matter. Antibiotics absorbed by plants increased their resistance to infection.

703. KRUPKA, L. Increased ascorbic oxidase activity induced by the fungal toxin, victorin. Science 128: 477-478. 1958.

Victorin, the toxin produced by Helminthosporium victoriae, caused three- to five-fold increases in respiration of oat tissues of susceptible oat varieties and failed to produce any appreciable effect on resistant varieties. The activity of the ascorbic oxidase system was also found to be four times as high in the susceptible varieties. This increase was produced by the victorin, and no effect on the ascorbic oxidase activity was noted in resistant varieties exposed to the victorin toxin.

704. LAKSHMANAN, M. and C. S. VENKATA RAM. Influence of Fusarium culture filtrates on respiratory changes in cotton. Proc. Indian Acad. Sci. Sect. B. 46: 131-137. 1957. (Biol. Abstr. 32: entry 35210. 1958.)

Culture filtrates of 21 species of Fusarium were tested for action on cotton tissue respiration.

705. LEAPHART, C. D. and O. L. COPELAND Jr. Root and soil relationships associated with the pole blight disease of western white pine. Soil Sci. Soc. Amer. Proc. 21: 551-554. 1957.

As the severity of pole blight increases, rootlet mortality increases and available water storage capacity and effective soil depth becomes less. These results indicate an edaphic relationship to the pole blight disease.

706. LOCHHEAD, A. G. Soil bacteria and growth-promoting substances. Bacteriological Reviews 22: 145-153. 1958.

Microbial growth-promoting substances in soil and organisms requiring or synthesizing them are discussed.

707. PREUSS, H. Untersuchungen zur Ökologie und Bedeutung der Tabakmykorrhiza. (Studies on the ecology and significance of tobacco mycorrhiza.) Naturwissenschaften 44: 592. 1957. (Rev. Appl. Mycol. 37: 248. 1958.)

Tobacco plants inoculated with endotrophic mycorrhiza developed better than uninoculated plants. The fungus spreads through the root filling the entire primary cortex with hyphae, arbuscules and vesicles. Root infection may be accomplished by means of either mycelium from root debris or germinating vesicles.

708. PRINGLE, R. B. and A. C. BRAUN. Constitution of the toxin of Helminthosporium victoriae. Nature 181: 1205-1206. 1958.

Further work showed that the toxin isolated from H. victoriae is very unstable. Victoxinine at $2.5 \times 10^{-4}$M completely inhibited the root growth of both toxin-susceptible and resistant oats. It may be responsible for the toxicity of the complete toxin, specificity being a function of the peptide portion.

709. STEPANOVA, L. N. and E. M. FISH. (On toxic bacteria in turf-podsol soils.) Bull. Acad. Sci. U.S.S.R., Ser. Biol. 23: 361-368. 1958. (Rev. Appl. Mycol. 37: 707. 1958.) (English summary)

Of 142 cultures of bacteria isolated from slightly cultivated ploughed

turf podsol, 42 inhibited wheat seedlings, particularly the development of the root system. Most of the toxic ones were sporogenous. Among those particularly abundant was Pseudomonas fluorescens.

710. TALBOYS, P. W. The possible significance of toxic metabolites of Verticillium albo-atrum on the development of hop wilt symptoms. Trans. Brit. Mycol. Soc. 40: 415-427. 1957. (Biol. Abstr. 32: page 2083, entry 24984. 1958.)

Culture filtrates of V. albo-atrum induced desiccation and necrosis in hop shoots, but the intensity of this action bore no relation to either the pathogenicity of the fungus or to the wilt tolerance of the host. From this observation and earlier evidence from intervarietal graft complexes it is suggested that in a determinative phase of the host-parasite relationship, the interactions which determine the degree of tolerance of the host and the pathogenicity of the fungus lead to the establishment of varying intensities of vascular invasion in the root system. In a secondary expressive phase, continued but sometimes restricted activity of the fungus results in the development of visual symptoms, possibly through a toxigenic mechanism in which symptom intensity depends on toxin dosage and is related to the amount of mycelium present in the vascular system.

711. TAMARI, K. and J. KAJI. Blast disease of rice plants. III. The effect of piricularin on the enzyme system of rice plants. Nippon Nogei-Kagaku Kaishi 31: 383-387. 1957. (Chem. Abstr. 52: 15658 (c). 1958.)

Piricularin, a toxic substance produced by Piricularia oryzae, gave a strong inhibitory effect on the respiration and growth of rice plants in concentrations above $2 \times 10^{-6}$; it had an activating effect at a more dilute concentration.

712. TOLLE, R. and A. RIPPEL-BALDES. Untersuchungen über die Rhizosphäre von Gramineen. (Studies on the rhizosphere of Gramineae.) Zbl. Bakt. Abt. 2, 111: 204-217. 1958. (Rev. Appl. Mycol. 37: 523. 1958.)

Forty species of fungi were isolated with varying frequency from the rhizospheres of oats, wheat, rye and barley. Culture filtrates of the isolates from barley rhizospheres exerted a powerful inhibitory effect on wheat root growth, but at dilution 1:100 to 1:1000 were stimulatory. Filtrates from four strains of Penicillium were only slightly stimulatory at 1:1000, while causing marked retardation of root growth at the other dilutions. It is postulated that the culture filtrate contains both inhibitory and activating thermostable substances overlapping in their operation.

## Toxins and Other Substances of Biotic Origin -- Plant Origin -- Affecting Micro-organisms

713. BOCHOW, VON H. Beiträge zur Frage des Einflusses einer organischen Düngung auf den Befall von Pflanzen durch parasitische Pilze. I. Über den Einfluss verschiedener Kompostgaben auf den Herniebefall. (Contributions to the question of the influence of organic manuring on the attack of plants by parasitic fungi. I. The influence of different doses of compost on attack by club root (Plasmodiophora brassicae Wor.).) Phytopath. Z. 33: 127-134. 1958.

In pot experiments it was shown that different amounts of compost added to a sandy soil infested with Plasmodiophora brassicae produced different effects on the club root attack in mustard. In mildly infested soil a small addition of compost (3-5 percent by weight) produced a slight increase in attack, whereas an increase in the amount of compost added caused a reduction in the degree of attack.

714. BUXTON, E. W. A change of pathogenic race in Fusarium oxysporum f. lini induced by root exudate from a resistant host. Nature 181: 1222-1224. 1958. (Rev. Appl. Mycol. 37: 615-616. 1958.)

A culture of race 1 of F. oxysporum f. pisi was induced to behave like race 2, in that it wilted Wilt-Resistant Alaska pea, by 14 days' incubation

of the spores in root exudates of that variety. Pathogenicity was increased more by a concentrated than by a dilute exudate.

715. BUXTON, E. W. Differential rhizosphere effects of three pea cultivars on physiologic races of Fusarium oxysporum f. pisi. Trans. Brit. Mycol. Soc. 40: 305-316. 1957.

Pea cultivars Onward, Alaska, and Delwiche Commando, differential hosts for three physiologic races of F. oxysporum f. pisi, exert different effects on the soil microflora.

716. DE LAEY, P. and A. I. VIRTANEN. On antifungal factors in carrots. Suomen Kemistilehti 30B: 218. 1957. (in English.) (Chem. Abstr. 52: 12100 (i). 1958.)

A 70 percent alcohol extract of carrots completely inhibited the growth of Fusarium nivale on agar. By paper chromatography, the identified active constituents are chlorogenic acid, caffeic acid, gallic acid, and $\alpha$-pinine.

717. ELAROSI, HUSSEIN. Fungal associations. III. The role of pectic enzymes on the synergistic relation between Rhizoctonia solani Kühn and Fusarium solani Snyder and Hansen, in the rotting of potato tubers. Ann. Botany, N.S. 22: 399-416. 1958.

The role played by pectic enzymes upon the synergistic relation of Rhizoctonia solani and Fusarium solani on rotting potato tubers is discussed.

718. GRAHAM, J. H. Effect of gibberellic acid on damping-off of Ladino white clover. Plant Disease Reptr. 42: 963-964. 1958.

Gibberellic acid applied at 10 and 40 ppm to seed of Ladino white clover increased the amount of pre-emergence damping-off in soil infested with Pythium debaryanum. Post-emergence damping-off was increased significantly by gibberellic acid in soil infested with P. debaryanum, Rhizoctonia solani, and Fusarium roseum. Since the chemical had no measurable effect on the three fungi in culture it is assumed that the altered growth of the seedlings (spindly and light green) increased their susceptibility to the damping-off organisms.

719. HERZOG, W. and H. WARTENBERG. Untersuchungen über die Lebensdauer der Sklerotien von Rhizoctonia solani (Kühn) im Boden. (Investigations on the duration of life of sclerotia of Rhizoctonia solani in the soil.) Phytopath. Z. 33: 291-315. 1958.

Decaying parts of plants such as remains of potato haulms and tubers have an inhibiting effect on Rhizoctonia solani since they provide an excellent substrate for fungistatic antibionts. The action of the rhizosphere of higher plants seems to protect the Rhizoctonia against the antibionts.

720. JACKSON, R. M. An investigation of fungistasis in Nigerian soils. J. Gen. Microbiol. 18: 248-258. 1958.

The presence of a fungistatic factor in local soils was demonstrated by inoculating agar disks on filter-paper in contact with moist, non-sterile soil with spores of 19 species of fungi. The results suggest the occurrence in Nigerian soils of a material inhibitory to fungi, similar to that occurring elsewhere and probably universally present in soils.

721. JACKSON, R. M. Some aspects of soil fungistasis. J. Gen. Microbiol. 19: 390-401. 1958.

Six out of seven different soils exhibited a spectrum of inhibition to a series of test fungi. The inhibitory effect decreased with increasing soil acidity. It is suggested that spores are most sensitive to soil fungistasis at an early stage in the process of germination.

722. JACKSON, R. M. Studies on fungistasis in soil. In Report of the Rothamsted Experimental Station for 1957, pp. 80-81. (Rev. Appl. Mycol. 37: 630-633. 1958.)

The lowest inhibition of germination of a test fungus was produced by soil from a more acid plot and the highest from less acid. Evidence

suggested that aerobic, spore-forming bacteria may cause natural soil fungistasis.

723. KALYANASUNDARAM, R. Production of fusaric acid by Fusarium lycopersici Sacc. in the rhizosphere of tomato plants. Phytopath. Z. 32: 25-34. 1958.
It was shown that an antibiotic-like fusaric acid could be synthesized in natural soils if there are favourable microhabitats.

724. LEE, S. and D. Le TOURNEAU. Chlorogenic acid content and Verticillium wilt resistance of potatoes. Phytopathology 48: 268-274. 1958.
Varieties resistant to Verticillium wilt contained more chlorogenic acid in the roots than did susceptible varieties.

725. LOCKWOOD, J. L. Streptomyces spp. as a cause of natural soil fungitoxicity. (Abstr.) Phytopathology 48: 395. 1958.
Mycelium of various fungi was lysed 1-2 weeks after agar cultures were covered with natural or organic soils.

726. MARTIN, P. Einfluss der Kulturfiltrate von Mikroorganismen auf die Abgabe von Scopoletin aus den Keimwurzeln des Hafers (Avena sativa L.). (Effect of culture filtrates of microorganisms on the secretion of scopoletin from the radicle of oats.) Arch. Mikrobiol. 29: 154-168. 1958.
Scopoletin (6 methoxy-7-hydroxycoumarin) is excreted by the roots of oats under unfavorable conditions. This excretion is stimulated by culture filtrates of a bacterium species and Fusarium moniliforme.

727. NAIM, M. S. and HUSSEIN, A. M. Growth responses of Fusarium oxysporum to metabolites of some rhizospheric microflora of Egyptian cotton varieties. Nature 181: 578. 1958.
Of the rhizospheres of different cotton varieties examined, a variety resistant to F. oxysporum wilt had the highest populations of Bacillus subtilis, while that of the susceptible variety had the highest numbers of B. megaterium. B. subtilis was highly antagonistic to F. oxysporum in culture while B. megaterium stimulated mycelial production.

728. RAIBLE, K. and A. I. VIRTANEN. (Antifungal factor from the whortleberry plant.) Acta Chem. Scand. 11: 1432-1434. 1957. (Chem. Abstr. 52: 7619 (h). 1958.)
A highly active antifungal factor against Fusarium nivale was obtained from the green portions of the whortleberry plant (Vaccinium myrtillus).

729. SCHÖNBECK, F. Untersuchungen über den Einflusz von Wurzelausscheidungen auf die Entwicklung von Bodenpilzen. (Studies on the influence of root secretions on the development of soil fungi.) Naturwissenschaften 45: 63-64. 1958. (Rev. Appl. Mycol. 37: 398-399. 1958.)
Of the various crucifers, legumes and cereals tested only oats produced a substance that inhibited the growth of Byssochlamys nivea in the rhizosphere. On the basis of paper chromatographic analyses the substance is tentatively identified as a root-tip glucoside.

730. STARKEY, R. L. Interrelations between microorganisms and plant roots in the rhizosphere. Bacteriological Reviews 22: 154-172. 1958.
The rhizosphere is the seat of active microbial development, it is here that the principal effects of the soil are expressed on the plant and it is here that the diverse activities of microorganisms have their greatest influence on plant development. There are suggestive results on the beneficial and injurious effects of the rhizosphere microorganisms on plants.

731. STOVER, R. H. Studies of Fusarium wilt of bananas. III. Influence of soil fungitoxins on behaviour of F. oxysporum f. cubense in soil extracts and diffusates. Can. J. Botany 36: 439-453. 1958.
Germination, hyphal growth, sporulation and chlamydospore formation in culture were inhibited by different soil extracts and diffusates. The

alkaline clays being more fungitoxic than the acid loams there was a strong indication that the fungitoxins were associated with the bacterial soil flora.

732. VALLE, E. On anti-fungal factors in potato leaves. Acta Chem. Scand. 11: 395-397. 1957. (Rev. Appl. Mycol. 37: 210-211. 1958.)
Highly active anti-fungal extract was obtained from leaves of field-grown Aquila potato plants resistant to Phytophthora infestans. These substances also inhibited the growth of Fusarium nivale.

Toxins and Other Substances of Biotic Origin -- Plant Origin -- Affecting Plants

733. BÖRNER, H. Untersuchungen über den Abbau von Phlorizin im Boden. Ein Beitrag zum Problem der Bodenmüdigkeit bei Obstgehölzen. (Studies on the decomposition of phlorizin in the soil. A contribution to the problem of soil sickness in fruit trees.) Naturwissenschaften 45: 138-139. 1958. (Hort. Abstr. 28: page 556. 1958.)
The author suggests that phlorizin is one of the toxins in the soil causing soil sickness in apple. The substance is present in fairly large amounts in the bark of apple roots from which it diffuses into the soil.

734. BURKILL, I. H. Inhibition of germination of the white mustard by bryony juice. Proc. Linn. Soc. London 169: 62-63. 1958. (Biol. Abstr. 32: 3494, entry 42008. 1958.)
The germination of seeds of Brassica alba was inhibited and growth of seedlings stopped by juice of berries of Tamus communis. Juice from berries of Solanum nigrum also inhibited germination. It is suggested that saponin might be the active substance.

735. HAVIS, L., H. F. MORRIS, R. MANNING and T. E. DENMAN. Responses of replanted peach trees to soil treatments in field tests in Texas. Proc. Amer. Soc. Hort. Sci. 71: 67-76. 1958.
Young peach tree replanting tests at Brownwood, Tyler and Stephenville, Texas, were made on old peach sites. At Brownwood, where the replant problem was most serious, soil fumigation with methyl bromide gave striking benefits in new tree growth. Soil treatments with lime and various fertilizers failed to show any effects on the growth or survival. At Tyler and Stephenville several chemicals, as well as lime and fumigation treatments, failed to give significant benefits in growth of trees up to 3 years.

736. HIRANO, S. Studies on peach sick soil. IV. Effect of dilution of sick soil and of peach leaf extract on the growth of peach seedling. (Japanese, with English summary.) J. hort. Ass. Japan 26: 261-266. 1957. (Hort. Abstr. 28: page 375. 1958.)
Peach seedlings were grown in old peach soil diluted to varying extents with virgin soil. Growth improved with increasing proportions of virgin soil reaching a maximum at 1 part of peach soil to 999 parts virgin soil. Growth was inhibited with undiluted water extracts of peach leaves.

737. LAŠTŮVKA, Z. (Growth and metabolism of wheat and rye in mixed cultures.) (In Czech with English summary.) Folia Biol. (Prague) 4: 119-126. 1958. (Biol. Abstr. 32: 3492, entry 41992. 1958.)
The growth of wheat is inhibited in mixed cultures with rye, while the growth of rye is stimulated. It was assumed that all the changes are due to specific, mutually absorbed substances secreted by both species, the different degree of stimulation or inhibition being related to the concentration of these substances.

738. MARCELLI, E. (An interesting manifestation of "frenching" in association with symptoms of potassium deficiency in tobacco.) Ric. fitop. Campan., 13-14: 107-117. 1957. (English summary.) (Rev. Appl. Mycol. 37: 376-377. 1958.)
Virginia Bright tobacco plants developed frenching together with symptoms of K deficiency. Soil applications of K caused the deficiency symptoms to disappear and markedly reduced frenching. Stable manure also largely reduced frenching.

739. MARTIN, H. Chemical aspects of ecology in relation to agriculture. Publ. Dep. Agric. Can., Sci. Serv., 1015 (Res. Monogr. Sci. Serv. Lab.) 1957, 96 pp., Queen's Printer, Ottawa. 1958.

This book classifies and correlates information on the chemical factors involved in the symbiotic and antibiotic relations between plants, insects, the microflora, and the soil. The chapters include information on the production of phytotoxins by higher plants; the role of phytotoxins in plant pathology; the chemical basis of biological control; the ecological and practical significance of fungal antagonism; the practical utilization of fungicidal antibiotics; and the ecological chemistry of bacteria.

740. MARTIN, J. P. and J. O. ERVIN. Greenhouse studies on influence of other crops and of organic materials on growth of orange seedlings in old citrus soil. Soil Sci. 85: 141-147. 1958.

Studies were conducted in the greenhouse to determine (a) the variation in the reduced growth condition of southern California citrus soils; (b) whether growth of other plants was retarded in old citrus soils; and (c) the influence of organic materials, companion crops, and crop rotation on growth of orange seedlings in old citrus soils. Rotation crops exerted variable effects on growth of orange seedlings in two old citrus soils. The majority tended to increase growth; grass crops were more effective than legume crops. In Yolo sandy loam a rotation crop of brome grass was almost as effective as fumigation in stimulating growth.

741. PATRICK, Z. A. and L. W. KOCH. Inhibition of respiration, germination, and growth by substances arising during the decomposition of certain plant residues in the soil. Can. J. Botany 36: 621-647. 1958.

Substances capable of markedly inhibiting the respiration, germination, and growth of tobacco seedlings were obtained after residues from timothy, corn, rye or tobacco plants had been allowed to decompose under appropriate conditions in the soil. The toxic substances exhibited an inhibiting effect on respiration of tobacco seedlings after an exposure of less than 1 hour and also induced darkening and necrosis of root cells. Some extracts affected the cells of the apical meristem most severely while others affected only the cells of the elongation region. The toxic substances possessed antifungal activity also. It is believed that these toxins may perform a significant role in the field as the primary cause of some root rots and in predisposing plants to attack by organisms not normally regarded as pathogenic.

742. PEERS, F. G. Germination inhibitory substances in oat husk. W. African J. Biol. Chem. 2: 9-14. 1958. (Chem. Abstr. 52: 20448(d). 1958.)

Aqueous extracts of oat husk are inhibitory to germination of other seeds but not to oats. The activity is ascribed to organic acids, principally succinic, acetic, fumaric, and malic acids.

743. SCHANDER, H. Über die Bodenmüdigkeit beim Apfel und über Versuche, Marschböden auf Bodenmüdigkeit zu testen. (On soil sickness in apples and on experiments to test marshy soils for soil sickness.) Mitt. ObstVersuchsringes Jork 13: 188-195. 1958. (Hort. Abstr. 28: page 556. 1958.)

The article is largely a discussion on the problem of genuine soil sickness in deciduous fruits and on the possibility of diagnosing the malady by analysing the soil for the presence of certain glycosides.

744. STOLWIJK, J. A. J. and K. V. THIMANN. On the uptake of carbon dioxide and bicarbonate by roots, and its influence on growth. Plant Physiol. 32: 513-520. 1957.

Growth of roots of Pisum sativum, Vicia faba, Phaseolus vulgaris, and Helianthus annuus is completely inhibited if the root medium is aerated with 6.5 percent $CO_2$ in air. Avena sativa and Hordeum vulgare are almost unaffected by such a treatment.

745. LIN, K.-H. Observations on yellow shoot of citrus. Etiological studies of yellow shoot of citrus. (Chinese, Abs. from English summary.) Acta Phytopath. Sinica 2: 1-42. 1956. (Rev. Appl. Mycol. 37: 41. 1958.)

Symptoms include rotting of rootlets. In field experiments there was no evidence that it was caused by water injury or by nematodes. Fusarium spp. were not responsible but could invade weakened roots. Inoculation by budding indicated that the disease is of virus origin and transmitted naturally.

746. LIN, K.-H. and M.-L. CHU. The relation of Fusarium species to yellow shoot of citrus. Acta Phytopath. Sinica 3: 169-176. 1957. (Rev. Appl. Mycol. 37: 408. 1958.)

Two of 14 tangerine orange trees in drums developed root rot and yellowing 4 months after soil inoculation with Fusarium, subsequent recovery by formation of new fibrous roots being followed by recurrence of the disease. It would appear that Fusarium spp. can attack the roots of citrus and augment the effects of yellow shoot virus disease.

747. NOORDAM, D. Tabaksnecrosevirus in samenhang met een oppervlakkige aantasting van aardappelknollen. (Tobacco necrosis virus associated with a superficial affection of potato tubers.) Tijdschr. Plantenziekten 63: 237-241. 1957. (Biol. Abstr. 32: 2086, entry 24924. 1958.)

Tobacco necrosis virus caused three types of symptoms on various potato varieties: dark brown lesions with star-shaped or reticular cracks, somewhat resembling scab and only superficially present in the flesh; light brown lesions with or without cracks; and in storage blisters may develop changing into sunken areas.

748. WALKINSHAW, C. H. and R. H. LARSON. A soil-borne virus associated with the corky ringspot disease of potato. Nature 181: 1146. 1958.

A sap-transmissible, rod-shaped virus carried in the soil was recovered from Sebago potato tubers affected by corky ring spot (spraing) at the University of Wisconsin, Madison, U.S.A. The virus, named "potato corky ringspot virus", was related serologically to the viruses of potato stem mottle and tobacco rattle but produced different symptoms.

SENIOR AUTHOR INDEX
(numbers refer to entries)


Abe, T., 312
Abo-el-Dahab, M. K., 9
Alandia, S., 228
Antoine, R., 81
Anzalone, L., 653
Ark, Peter A., 10, 18
Armstrong, G. M., 150, 151
Armstrong, J. K., 152
Ashour, W. A., 89, 90, 622, 678
Asthana, R. P., 91

Bachy, A., 153
Bain, Douglas C., 574
Baines, R. C., 414, 415, 465, 628
Bakshi, B. K., 82
Ballard, J. C., 200
Barrie, A. G., 265
Barton, R., 364
Bartz, J. F., 679
Bates, G. R., 328
Beaumont, A., 654
Beltra, R., 19
Benedict, S. H., 392
Besemer, A. F. H., 393
Bianchini, C. L., 92
Bilbruck, J. D., 141
Bingham, F. T., 229
Birchfield, Wray, 387, 388
Bird, Alan F., 466
Bird, L. S., 623
Bishop, Daphne, 394
Blanco, L. C., 681
Błaszczak, W., 301
Bochow, Von H., 713
Böhm, O., 416
Bojnansky, V., 319
Bonde, R., 11
Bonilla, E., 313
Böning, K., 93
Boosalis, M. G., 145
Börner, H., 733
Boyce, A. M., 230
Brande, J. van den, 389, 417
Braun, A. J., 467
Brian, P. W., 700
Brien, R. M., 94
Brook, M., 682
Brown, A. L., 395
Brown, E. B., 468, 469
Brown, M. E., 365
Buddenhagen, I. W., 20
Bunkina, I. A., 95
Burgis, D. S., 683
Burkill, I. H., 734
Burton, C. L., 329
Busch, L. V., 683
Butler, Edward E., 366
Buxton, E. W., 330, 714, 715
Byford, W. J., 231

Calavan, E. C., 232
Caldwell, R., 59
Carroll, K. K., 470, 600
Caveness, Fields E., 471
Cetas, R. C., 684
Chambers, S. C., 685
Chant, S. R., 233
Chapman, R. A., 472, 601
Chatterjee, P., 154
Chattopadhyay, S. B., 155
Chevaugeon, J., 96
Chinn, S. H. F., 367
Christie, J. R., 396, 418, 473
Christie, T., 616
Ciferri, R., 655
Clark, R. V., 212, 213
Clayton, C. N., 419
Cleary, J. P., 660
Coe, D. M., 156
Colbran, R. C., 420
Cole, C. S., 474
Colhoun, J., 279
Collins, R. P., 157
Conners, I. L., 97
Conroy, R. J., 201
Converse, R. H., 234
Coulombe, L. J., 158
Coursen, B. W., 475, 476, 477
Craig, J., 98
Crittenden, H. W., 575
Culbertson, J. O., 202
Curtis, R. W., 701

Dadant, R., 143
Darpoux, H., 99
Davide, Romulo G., 647
Davies, R. R., 331
Davis, J. F., 332
Davison, Arlen D., 21
de Boer, S., 656
De Haan, I., 421
De Laey, P., 716
De Tempe, J., 619
DeVay, J. E., 159
Decker, P., 100
Deep, Ira W., 12, 13
Dekker, J., 686
den Ouden, H., 602
Desrosiers, R., 160
Dickason, E. A., 697
Dickerson, O. J., 478
Djiembaev, J. T., 214
Domsch, Klaus H., 629, 630, 631
Dona Dalle Rose, A., 397
Dowson, W. J., 22
Drake, Charles R., 101
Drolsom, P. N., 576, 577
Dropkin, V. H., 479
Dubey, H. D., 316
Duggan, J. J., 603

Ebben, Marion H., 102
Edgerton, L. J., 480
Edgington, L. V., 333, 617
Eichinger, A., 1
Elarosi, Hussein, 717
Elenkov, E., 334, 358
Ellenby, C., 481, 482, 483, 604, 605
Ellett, C. W., 2
Ende, G. v. d., 651
Endo, B. Y., 422
Epps, J. M., 484, 485
Erwin, Donald C., 161, 335, 363
Everette, G. A., 162

Farrar, Luther L., 423
Fassuliotis, George, 486
Fawcett, C. H., 632
Feder, W. A., 578, 606
Fedorinckik, N. S., 60
Fedotova, T. I., 61, 62, 320
Feldmesser, Julius, 487
Felix, E. L., 235
Fenwick, D. W., 607
Ferris, Virginia R., 488, 608
Ferver, A. F., 489
Fezer, K. D., 103
Fink, Henry C., 14, 687
Flentje, N. T., 302, 303
Fletcher, W. A., 266
Ford, H. W., 490, 609
Forsberg, J. L., 163
Foster, H. H., 424
Frezzi, M. J., 287
Frezzi, Mariano, 236
Fry, P. R., 223
Fulkerson, J. F., 23
Fulton, N. D., 104
Fulton, R. H., 105

Gandel'man, T. C., 63
Garber, E. D., 24
Garrett, D. S., 64
Gasiorkiewiez, E. C., 667
Gaskin, Timothy A., 491
Gedz, S. M., 321, 322
Gertler, S. I., 398
Gerlach, W., 164
Gibson, I. A. S., 137
Gilbert, J. C., 579
Giles, D. E., 580
Gill, D. L., 492
Gilmour, C. M., 368
Goffart, H., 425
Golden, A. Morgan, 493, 581, 582, 583
Gomolyako, M. I., 106
Gondo, M., 633
Good, J. M., 426, 427, 494
Goodey, J. B., 495
Goodman, R. N., 661
Gorlenko, M. F., 280

Goss, Robert C., 662
Gottlieb, David, 225
Gould, Charles J., 369
Graham, C. D., 25
Graham, C. W., 496
Graham, J. H., 718
Graham, T. W., 497
Grainger, J., 428
Granhall, I., 26
Grant, U. J., 107
Grassi, G. V., 65
Gray, E. G., 165
Green, R. J. Jr., 336
Green, V. E., 304
Griffiths, E., 66
Grogan, R. G., 224
Grossman, F., 618
Groves, A. B., 108
Guntz, M., 3

Hagedorn, D. J., 166
Hague, N. G., 498, 610
Hahn, S., 499
Haller, H. L., 429
Halpin, J. E., 288
Hampton, R. O., 289
Harris, R. V., 267, 337
Harrison, A. L., 663
Harrison, D. J., 167
Hauke-Pacewiczowa, H., 634
Havis, L., 735
Hawker, Lilian E., 290
Hawn, E. J., 109, 110
Healy, A. J., 500
Henderson, V. E., 501
Hendrix, Floyd F. Jr., 168
Herr, Leonard J., 237
Herzog, W., 719
Hesling, J. J., 502, 503
Hewitt, W. B., 504
Hickman, C. J., 238
Hildebrand, A. A., 239
Hildebrand, E. M., 169
Hirano, S., 736
Hodges, C. S., Jr., 674
Hollis, J. P., 399, 400, 505, 611
Hopkins, J. C. F., 240
Hopper, B. E., 506
Horton-Smith, C., 111
Houston, Byron R., 170
Hughes, C., 338
Hunter, A. H., 507
Husain, Akhtar, 27, 28
Hwang, L., 171

Ishizawa, S., 370
Ivanchenko, Y. N., 112

Jackson, R. M., 720, 721, 722
Jamalainen, E. A., 172
James, N., 371

Jenkins, W. R., 430
Jensen, Harold J., 508
Johnson, E. M., 241
Johnson, F. R., 668
Johnston, Titus, 509
Jones, F. G. W., 584
Jones, T. W., 147
Jurinak, J. J., 401

Kalyanasundaram, R., 723
Kantzes, J. G., 221, 431
Kaufmann, M. J., 242
Kelsheimer, E. G., 432, 433
Kemp, W. G., 227
Kenaga, Eugene E., 402
Kendrick, J. B., 113, 291
Kerr, A., 372
Keyworth, W. G., 216, 217
Kiessig, R., 339
Kirkpatrick, J. D., 510
Kirkpatrick, R. A., 698
Kivilaan, A., 29
Klein, R. M., 30
Klemm, M., 31
Kling, E. G., 173
Klotz, L. J., 243, 244, 245, 268, 269, 373, 650
Kon'kova, R. D., 83
Kovachevski, I., 246
Krasil'nikov, N. A., 702
Krupka, L., 703
Krusberg, L. R., 511, 512
Kublanovskaja, G. M., 67
Kuiper, K., 434
Kulmatycka, I., 305
Kurata, H., 306

Lakshmanan, M., 704
Lakshminarayanan, K., 174
Lange, A. H., 435, 436
Lange-de-la-Camp, Maria, 215
Laštůvka, Z., 737
Leach, C. M., 307
Leach, R., 513
Leaphart, C. D., 705
Lear, B., 437
Lee, S., 724
Leont'eva, Y. A., 648
Lester, E., 514
Lewis, G. D., 438, 515
Lin, K. H., 745, 746
Lindberg, G. D., 292
Linden, G., 669
Lindström, Olle, 670
Lochhead, A. G., 706
Lockwood, J. L., 725
Loos, C. A., 403, 404
Lopez, M. A., 688
Lordello, L. G. E., 439, 516, 517, 518, 519, 520
Louw, H. A., 79, 80
Lownsbery, B. F., 440, 521
Lucas, G. B., 32

MacFarlane, I., 374
Machacek, J. E., 114
Machmer, J. H., 522
MacLachlan, D. S., 15, 33
MacLagan, D. S., 523
Macura, J., 375
Mai, W. F., 390, 612
Maklakova, G. F., 281
Maloy, O. C., 376
Mankau, R. A., 585
Marcelli, E., 34, 247, 738
Marlatt, Robert B., 175, 286
Martin, G. C., 524
Martin, H., 739
Martin, J. P., 176, 405, 740
Martin, P., 726
Martin, W. J., 4
Maslenikov, I. P., 385
McGlohon, Norman E., 586
McGuire, D. C., 587
McGuire, J. M., 525
McKee, R. K., 5
McKeen, W. E., 248, 270
Meagher, J. W., 526
Meijneke, C. A. R., 386
Menzies, J. D., 377, 689
Messiaen, C. M., 115
Meuli, Lloyd, J., 635, 636
Meyer von Gregory, Ruth, 35
Miller, H. N., 675
Miller, P. M., 406, 441, 442
Miller, P. W., 359
Miller, Robt. E., 637
Mirzabekyan, R. O., 68
Molin, Nils, 148
Moore, W. C., 323
Moreau, M., 340, 341
Moreton, B. D., 527
Morgan, G. C., 324
Morgan, O. D., 36, 443
Morton, George, 271
Morwood, R. B., 116
Moskovets, S. N., 69
Mountain, W. B., 528, 529
Mukula, J., 318
Mulvey, Roland H., 530, 531
Mungomery, R. W., 249
Munnecke, Donald E., 638, 639, 671
Mygind, H., 325

Naim, M. S., 727
Nair, P. N., 203
Natti, J. J., 342, 690
Neely, R. D., 177
Nelson, K. S., 37
Nelson, Paul E., 117, 343
Nemlienko, F. E., 649
Newhall, A. G., 532, 672

Newhook, F. J., 250
Newton, W., 360
Nishimura, S., 178, 179
Noordam, D., 118, 747
Norton, Don C., 533
Novello, C., 344
Nusbaum, C. J., 534

O'Bannon, J. H., 444
Ochse, J. J., 204
Olsen, C. M., 657
Oostenbrink, M., 535, 536
Orian, G., 146
Ostazeski, S. A., 180
Overman, A. J., 691

Paasuke, M., 391
Palmer, John G., 205
Papaïoannou, A. J., 119, 345
Park, David, 70, 71, 378
Parker, K. G., 537
Parkinson, D., 181
Parris, G. K., 407
Partyka, R. E., 315
Pate, J. B., 588
Patrick, Z. A., 741
Peake, R. W., 38
Peers, F. G., 742
Pelletier, R. L., 206
Perry, Vernon G., 538, 539
Persing, C. O., 445
Peters, B. G., 540
Petersen, L. J., 658
Peterson, E. A., 379
Phillips, D. H., 6, 346
Pieringer, A. P., 7
Pirone, P. D., 209
Pitcher, R. S., 541, 542
Pontoriero, P. L., 446
Porter, Frank M., 16
Porzhenko, V. V., 620
Potter, H. S., 692
Powell, N. T., 589
Prasad, N., 122
Pratt, M. H., 347
Prendergast, A. G., 182
Preuss, H., 707
Příhoda, A., 183
Pringle, R. B., 708
Protsenko, E. P., 184
Pucci, E., 447
Pulsifer, H. G., 144
Purss, G. S., 251
Putt, E. D., 361

Raabe, R. D., 138, 348
Rabinovich, Z. D., 123
Ragimov, U. A., 124
Raheja, P. C., 185
Raible, K., 728
Ranney, C. D., 624, 625, 673
Raski, D. J., 448, 543
Reid, James, 186, 187
Renninger, George, 449
Reynolds, Harold W., 450, 451
Ribaldi, M., 40, 41
Rich, Saul, 226, 308
Richardson, L. T., 42
Riggenbach, A., 149
Riggs, R. D., 590
Ritter, M., 452, 544, 545
Roane, C. W., 621
Robinson, D. B., 349
Rodríguez, Ricardo A., 314
Rohde, R. A., 591, 592
Ross, J. P., 350, 593
Ruehle, J. L., 546
Rui, D., 453
Russell, R. C., 84
Russo, G., 454

Sarejanni, J. A., 252
Sarmah, K. C., 125
Sauer, M. R., 547
Sauthoff, W., 188
Schander, H., 743
Schindler, A. F., 548, 549
Schneider, C. L., 136
Schneider, R., 189
Schnexnayder, C. A., 293
Schönbeck, F., 729
Sequeira, Luis, 43, 190
Sergeev, L. A., 72
Seth, J., 44
Sewell, G. W. F., 351
Sharan, N., 294
Sharpe, R. H., 594
Shepherd, Audrey M., 613
Sher, S. A., 408, 550
Shimomura, T., 207
Shoemaker, R. A., 253
Shopina, V. V., 73
Simmonds, J. H., 272
Simon, Ludwig, 551
Sinclair, J. B., 626, 627
Singh, B., 126
Skotland, C. B., 352
Slankis, V., 380
Sleeth, B., 455
Smith, Oliver F., 595
Smith, W. K., 45, 46
Southey, J. F., 552
Spruyt, F. J., 596
Srinivasan, K. V., 295
Srivastava, S. N. S., 140
Stalder, L., 127
Stanek, M., 640
Stanford, E. H., 597
Stankova-Opocenska, E., 85
Stark, C., 641
Starkey, R. L., 730
Starr, G. H., 47

Steele, Arnold E., 456
Stefanov, D., 664
Steindl, D. R. L., 48
Stenton, H., 381
Stepanova, L. N., 709
Stepantsev, I. N., 353
Stessel, G. J., 659
Stevenson, I. L., 382
Stolwijk, J. A. J., 744
Stover, R. H., 191, 192, 553, 731
Sudakova, I. M., 554
Summers, T. E., 555, 598
Suzuki, N., 210, 211

Taconis, P. J., 128
Takahashi, M., 296
Takeuchi, H., 642
Talboys, P. W., 354, 355, 710
Tamaqo, B. P., 86
Tamari, K., 711
Tammen, J., 193
Tarjan, A. C., 457
Tarr, S. A. J., 87, 699
Taylor, A. L., 556
Taylor, D. P., 557
Teakle, D. S., 194, 254, 255, 297
Ten Boer, H., 309
Termohlen, G. P., 129
Thomas, P. R., 458, 558
Thomason, Ivan J., 559
Thompson, H. S., 298
Thornton, R. H., 383
Tims, Eugene C., 643
Tiner, Jack D., 614
Todd, E. H., 560
Todd, F. A., 459
Todorova, V., 130
Tolle, R., 712
Tomlinson, J. A., 317, 665, 666
Topps, J. H., 644
Townshend, J. L., 561
Tracey, M. V., 562
Tsao, Peter H., 256
Tupenevich, S. M., 74
Turligina, E. S., 409, 460
Turner, P. B., 8
Tweedy, B., 139
Tyner, L. E., 88

Ullrich, J., 326

Vaartaja, O., 75
Valle, E., 732
Van Adrichem, M. C. J., 362
Van Andel, O. M., 195
Van der Zwet, T., 299
Van Emden, J. H., 310
Van Gundy, S. D., 563, 564
Vekemanz, J., 49
Verneau, R., 219
Viégas, A. P., 220
Viel, G., 410
Volcani, Z., 50
Volger, C., 676

Wagner, F., 131
Waid, J. S., 384
Walker, J., 218
Walkinshaw, C. H., 748
Wallace, H. R., 565, 566, 567, 568
Warren, G. F., 411
Waterhouse, Grace M., 257
Watkins, G. M., 693
Weber, G. F., 196, 311
Wedding, R. T., 300
Welvaert, W., 652
Whitney, N. J., 132
Wickens, G. M., 222
Widdowson, Elizabeth, 569, 570, 571, 572, 615
Wilhelm, Stephen, 694
Williams, T. D., 599
Wilski, A., 461
Winfree, J. P., 17
Winner, C., 573
Winslow, R. D., 462
Winstead, N. N., 463
Wolf, F. A., 273
Wolf, F. T., 197
Woodhead, C. E., 274

Yamamoto, W., 198
Yen, D. E., 208
Yin, S. Y., 76, 77
Young, Roy A., 695
Young, V. H. Jr., 412
Yount, W. L., 142

Zachos, D. G., 51
Zaleski, A., 356
Zentmeyer, G. A., 258, 259, 260, 275, 276
Zummo, Natale, 677

ACKNOWLEDGMENT

Acknowledgment is again due Dr. A. A. Hildebrand for considerable editing in the above undertaking, and Miss Dorothy MacLeod, Head, Field Libraries Unit, Department of Agriculture, Ottawa, for invaluable assistance in connection with organization, arrangement and rules.

THE BOTANY AND PLANT PATHOLOGY DIVISION,
CANADA DEPARTMENT OF AGRICULTURE